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GEOPHYSICS

Forty Mile Holes May Supply World's Power

By James Stokley

Some day the world's coal supply will be exhausted.

Then where will the world's supply of energy come from?

There is the possibility of using water power. Power may be obtained from the tides. Or perhaps directly from solar radiation.

But though the earth may yield up all of its available coal, there will still be energy left within it.

In digging some of the first of the great tunnels through the Alps, which, though high above sea-level, were really a mile or more below ground—in this case the top of the mountain—men were prostrated by the heat.

Hades has always been thought of as a hot place, and has been placed down in the center of the earth. What are the possibilities of tapping the fires of hell, or at least what nearest correspond to these ancient ideas?

It is generally believed that the center of the earth is hot, even though scientific modernists may have given up the idea of these regions being presided over by a fireproof, non-inflammable devil.

Not so many years ago speculations on obtaining heat from the earth were regarded as almost as much nebulous vaporizing as the steam itself emitted from the hot springs in various parts of the world.

But a few years ago Sir Charles Parsons, inventor of the steam turbine and one of the most distinguished of British engineers, made a suggestion. He proposed that scientific men should cooperate in sinking a shaft into the earth twelve miles deep. The suggestion was really a very conservative one, because he did not say that the shaft would be sure to bring untold wealth to its backers, or anything of the kind. The chief reason for doing it, as he said himself, was "We don't know what is down there, and we ought to."

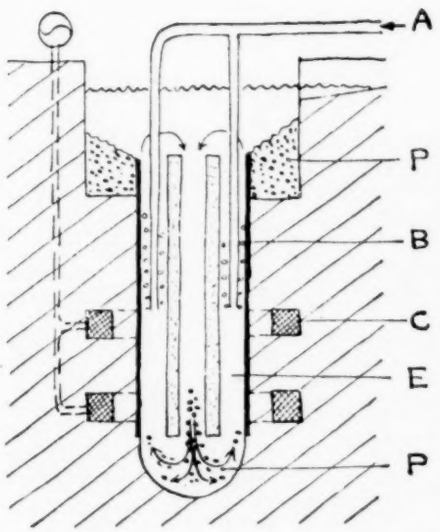

DIAGRAM OF HIGH TEMPERATURE BORE HOLE, for using the earth's heat for power, as proposed by John L. Hodgson, British engineer. This diagram is taken from Mr. Hodgson's book, and shows the method of digging the hole. A indicates pipes for introducing compressed air; B represents the bubbles of heated compressed air; C the alternating current circuits to melt the aluminum alloy, E, of the same density as the rocks through which the hole is bored.

Now another British engineer has carried the problem even further. At the recent meeting of the British Association for the Advancement of Science, in Leeds, the question came up again. Before the section on engineering of the association a paper was read by John L. Hodgson. In this paper he told of his exhaustive studies of the possibilities of digging such a shaft and using it as a source of power.

First of all is the amount of heat in the earth. According to Mr. Hodgson, it is 31 million times as great as the world's coal supply. The latter, he estimates, is 8,000,000,000,000 tons. This would raise the temperature of 6,400,000,000,000,000 tons of water from the freezing to the boiling point.

Why worry about our diminishing coal supply with all that heat beneath the soles of our shoes? But, asks the layman, isn't this supply of heat in the earth also limited, and if it is used up, won't it leave the earth a dead and cold planet, perhaps like the moon?

To this Mr. Hodgson responds with an emphatic "No!" As a matter of fact, the heat in the earth is continually being lost anyway. First it is conducted through the crustal rocks to the surface, and then it is radiated out into space. According to his estimates every square mile of the earth's surface radiates in a minute and a half as much heat as would be obtained by burning a pound of coal. If only 20 per cent. of this could be utilized as it flows out, a single square mile of surface would produce 40 horsepower. A thousand tons of coal burned in a second would produce the same amount of heat that the earth loses in a second. But instead of waiting for the heat to come to the surface, the best way seems to be to go down after it.

Even though all this heat is going out of the earth, it does not mean that our planet is getting cooler. This is what Mr. Hodgson says:

"This heat loss is wholly or partially balanced by new heat which is continually being generated in the earth's interior by rock friction, chemical change and radioactivity.

"The rate of heat production due to rock friction and chemical change has never been estimated.

"The rate of heat production in the surface layers due to radioactivity, however, seems to be more than suf-

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Forty-Mile Hole for Power

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ficient to make up for the relatively small amount of heat lost by radiation.

"It is therefore probable that the earth is getting hotter, and that the vast store of heat is increasing rather than diminishing."

Various attempts, in most cases quite successful, have already been made to use the heat of the earth. Even the primitive Maoris in New Zealand make use of hot springs for washing and cooking, while those in Iceland have long been used to aid the growth of vegetables.

Power from the earth, however, is more modern. There are three principal places where it has been accomplished, in California, in Italy and in Japan. The American installation has been in Sonoma County, about 105 miles north of San Francisco. This is a region somewhat resembling Yellowstone Park in that it contains a great number of hot springs and "mud baths," though real geysers are lacking. Five holes have been bored to a depth of about 450 feet in this region. Steam comes to the top with a pressure of 300 pounds per square inch. After allowing for losses in transmission, this gives 4,500 kilowatts of electricity, enough to supply heat and power for a good-sized town.

In Italy, at Larderello, in Tuscany, about 45 miles from Florence, is one of the most famous natural steam power plants. Prince Piere Ginori Conti, an Italian nobleman, has superintended this operation. The deepest of the twelve holes which have been sunk in the region there abounding in natural steam is 700 feet. From them is obtained 7,500 kilowatts of electrical power.

In the city of Beppu, on the island of Kyushu, in Japan, a start has been made to use power from hot springs. Here a small plant has been erected, while plans are under way to enlarge it.

These natural steam power houses are quite different from what Mr. Hodgson proposes, however, even though there are many places in the world where such projects might be carried out. In these places, the hot water or steam is produced by water from below passing through hot surface rocks. These, he says, may hold surprisingly large amounts of energy in the form of heat. One cubic mile of hot rock, he says, when cooled down 1,000 degrees Fahrenheit will yield as much heat as 182,500,000 tons of good coal. This, if used in a plant only 20 per cent. efficient will give 47,400,000 horsepower for a year.

"It is the vast reserves of a heat in the deeper crustal rocks and in the central core of the earth which must prove the great attraction to engineers until the problem is either solved or abandoned," says Mr. Hodgson.

To do this with our existing technical knowledge, he declares, would require the transfer of some material particles, as by a circulating liquid or gas, from the lower regions to the surface. If you hold a silver spoon in your hot coffee, the handle of the spoon soon becomes hot. Here the heat is conducted much as electricity is conducted along a wire. However, Mr. Hodgson does not believe that the heat that could be brought from many miles below the earth's surface to the top by any such means would be enough to pay for the cost involved. Neither does he think it practicable to use thermocouples, pairs of two different metals which give an electric current when heated. The current is too small.

Accordingly he suggests a bore hole, made double in form. Through a center pipe water descends from the surface. At the bottom it comes in contact with the outer wall and the heat of the earth at this depth converts it into steam. The steam then flows to the top to drive engines. If such a hole were a foot in diameter and 30 miles deep, he calculates that it would yield about 4,000 horsepower under ordinary working conditions, for the first 500 years.

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Scientists Discuss Bad Habits, Floods and Electrons

The annual meeting of the American Association for the Advancement of Science, with numerous associated organizations, held in Nashville, Tenn., from December 26 to 31 brought together several thousand of the country's leading scientists. A few of the most interesting and important papers are reported on this and the following pages. Next week more will be presented.

New Cure for Bad Habits

A new story of how habits are formed and how they may be cured was advanced before psychologists of the American Association for the Advancement of Science by Dr. Knight Dunlap, professor of psychology at Johns Hopkins University.

Bad habits, such as stammering, biting finger nails, or using a slang phrase can be overcome by voluntarily doing the undesirable thing, according to Dr. Dunlap's theory, and he described cases in which this method has been tried and found successful.

The psychologist's first subject to try the habit cure was himself. To break up the habit of writing "hte" on the typewriter for "the", he set to work deliberately and wrote half a page, singled spaced, of the "hte" combination, with the thought in mind that this was a "word" that he would not write in the future, unless it was done deliberately. About a week later he put in a second practice period, writing about one-third of a page. Since then, in a period of three months, the error of typing has not occurred, even once, he stated.

The theory is being tested with stammerers in a public school, Dr. Dunlap said, with favorable results.

"In the case of stammerers, the vital point is to study the specific type of stammering, and then induce the patient to reproduce voluntarily his characteristic verbal performance, criticising and assisting him until his voluntary stammering is as nearly as possible like his involuntary," he reported. "From that point on, the technique is complicated, and we do not expect to have it perfected until many cases have been experimentally subjected to it."

Thumb sucking and similar wrong habits of two- and three-year-old children have been treated at the Child Institute of Johns Hopkins University, he said, with results that show the method is useful even at such early ages.

In all cases patients have been selected who desired to cure the bad habit, for one reason or another, and have been carefully instructed that the voluntary performance, under the experimenter's control, would assist in abolishing the undesirable behavior at other times.

Dr. Dunlap's theory is in opposition to the generally accepted theory that repeating an act tends to fix it as a habit. Repetition in itself is important only because it brings into play other factors which establish the habit, he believes. In experiments so far conducted, it has been assumed that attention, expectation, and desire are among the important factors in making and breaking habits.

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Shortest Men in Tropics

The shortest people in the world are found in the climates of extreme heat or cold where the food supply is difficult and precarious, Prof. R. Bennett Bean of the University of Virginia told the Association.

The Negrillos of central Africa average around four feet four inches, according to Professor Bean's figures, while the Aymaras of central South America are close seconds. Next to these groups come the Eskimo, Lapps and Siberians, who live in regions of Arctic cold with a poor food supply. The tallest people, Professor Bean pointed out, are found in the temperate climates where active life is possible and an abundant food supply prevails, notably around the shores of the Baltic Sea, eastern Africa, and the plains and pampas of the Americas.

"Looked at in its broadest sense," he stated, "environment molds the individual, selection retains the fittest under different environments, and heredity carries on the results.

"Certain stocks may move into areas for which they are not fitted and remain for a time. Such conditions exist throughout the world today where recent movements of peoples have taken place, but ultimately there is a survival of the stock best fitted for the environment. The unfit stocks disappear in time by amalgamation, eradication or dispersal."

Sea areas and probably sea food have an influence in reducing stature by increasing the iodine intake, Professor Bean stated. The present Mediterranean peoples, for instance, and the primordial British, have small statures and so also the Japanese, yet they come from taller continental stocks.

Science News-Letter, December 31, 1927

Indians from Cro-Magnons?

The possible claim of the red-skinned natives of the Americas to descent from the noblest line of the Old Stone Age in Europe was set forth here recently by Dr. Ales Hrdlicka, noted anthropologist of the U. S. National Museum, Washington, D. C. Dr. Hrdlicka has just returned from a European trip during which he re-examined practically all of the known remains of paleolithic man. Speaking before the anthropological section of the American Association for the Advancement of Science, he outlined certain striking similarities both in bodily structure and in cultural customs between the Indians and the latest of the races of the Cro-Magnon type.

Dr. Hrdlicka said in part: "The recent revision which I have made of practically the entire extent of skeletal material from the Aurignacian times throws important new light on the problem of the Aurignacian ('Cro Magnon') man, a light which is at considerable variance with previous assumption. The new conclusions are in brief as follows:

"Early Aurignacian skeletal remains are exceedingly rare; the mass of the known remains belongs to the later, evolved, Aurignacian.

"The tall and powerful men of the Grimaldi caves represent not a racial character, but individual or a family variation. There are three of these skeletons, all male and all approaching giantism. Other skeletons from the same place are of ordinary dimensions.

"The assumed superiority of the brain of the Cro-Magnons over other races, past and present, is not sustainable, especially if the influence of stature on the size of the skull is discounted.

"The two negroid skeletons of Grimaldi (now preserved in the Museum of Monaco) are negroid more or less only in their facial appearance. Their low orbits, the forehead, the cranial vault, and all the main characteristics of the skeleton are so close to the rest of the Grimaldi individuals and to other members of the Grimaldi race, or Upper Aurignacians, elsewhere, that they can safely be regarded as fundamentally of

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Indians from Cro-Magnons?

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the same type and derivation. The negroid features of their face may be duplicated among other non-negro races, particularly the Malay and some of the American Indians. They differ very perceptibly even in the two skeletons.

"The supposed much greater antiquity of the two negroid skeletons is not supported either by their physical characteristics or their state of preservation, and the matter would seem to need a reconsideration. The case was plainly a double burial, and as such the remains may have been introduced into strata to which they would not properly belong.

"Some of the most characteristic and distinguishing features of the later Aurignacians relate to the shape and size of their ribs, which are unusually broad and strong; and to the shapes and relative sizes of their leg bones (tibia and fibula). The special characteristics of the leg bones extend as far as the Predmost skeletons of Moravia and the Paviland skeleton of England.

"There are growing indications that the uppermost Aurignacians may have been closely affiliated with the *far-away* European or Siberian ancestors of the older oblong-headed aboriginal Americans. There are many features in common to the two. The vault of the skull is often very similar in shape and size. Low orbits and other facial characteristics of the Aurignacians are also now and then met with in the Indians. There are certain Aurignacian-like similarities in the aboriginal American stone and bone culture. The habit of burying quantities of red ocher with their dead, was also common among the American Indians. While none of these items are decisive, they are nevertheless suggestive; and there is no inherent impossibility in the later Aurignacian influence, both morphological and cultural, reaching the old stock which eventually gave us the Indian. There are many indications that from the Middle Aurignacian times man began steadily to increase and extend over the earth; and that he remained much the same in physique through the succeeding terminal parts of the Paleolithic period and up to the Neolithic times when, according to the best evidence we now possess, he began gradually to extend or advance over into America."

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Electrons Like X-Rays

Experimental evidence in favor of some of the newest developments in electrical theory was reported to the American Physical Society by Dr. C. J. Davisson of Bell Telephone Laboratories, New York City. These experiments were concerned with the measurement of the way in which a beam of electrons is scattered by a single crystal of nickel. They showed that the scattering was governed by the same laws as those which govern the scattering of X-rays by a crystal.

"The scattering of X-rays by a crystal results in the production of strong scattered beams in just certain directions," Dr. Davisson stated, "and this fact has always been explained on the hypothesis that X-rays are an electromagnetic wave disturbance of the same sort as radio waves and visible light. Our experiments show that a beam of electrons shows these same characteristic scattering effects as X-rays. The inference seems to be that there is some sort of a wave-motion associated with the motion of a beam of electrons."

The experiments, which were performed jointly with Dr. L. H. Germer of the Bell Telephone Laboratories, showed that the observed wave-length of the electron beam was exactly that which is predicted by the quantum theory.

Describing the experimental method, Dr. Davisson explained that the source of the electrons was a hot filament just as in ordinary radio tubes. The voltage used ranged from about fifty to 375. The beam of electrons impinged on a nickel crystal, and some of them were absorbed in it, while others were scattered back from the surface. Of those that are scattered back some come back without having lost any speed—they have elastic encounters with the crystal like the impact of a billiard ball on a cushion.

A little collecting device was arranged so that it would be moved to various positions in front of the crystal to find how many electrons were scattered in the various directions without loss of speed. With this arrangement the number of electrons scattered in different directions was found to depend on the direction in the same way as does the scattering of X-rays by a crystal.

"The situation confronting physicists with regard to electrons is now something like the dilemma confronting the theory of light," the speaker declared. "For many years all the facts concerning light could

(*Just turn the page*)

Higher Floods Possible

High though the 1927 floods of the Mississippi were, and the most disastrous in our history, they did not represent the highest possible. It is conceivable that a future one may occur with crests two to four feet higher. This was the opinion expressed before the symposium on floods at the meeting of the American Meteorological Society by Dr. H. C. Frankenfield, in charge of the flood investigations of the U. S. Weather Bureau. Dr. Frankenfield was careful to add, however, that the chances of the maximum occurring are exceedingly remote.

"The lower Mississippi floods," said Dr. Frankenfield, "are caused mainly by heavy and favorably distributed rains over the great central basins. The Missouri River above the mouth of the Platte, and the Mississippi River above the mouth of the Wisconsin, do not contribute materially. In 1927, the time, amount and distribution of the rains was so favorable that the greatest flood in our history occurred.

"The amount of contributing rainfall for the floods of 1922 and 1927 did not differ materially and other factors were materially alike in January and February. The difference resulted from the March and April precipitation, the excess during April, 1927, determining the question in favor of 1927. The water depths over the entire basin from January to April, inclusive, in 1922 and 1927 were 10.58 and 10.79 inches, respectively, a difference of only 0.21 inch, not enough to cause any material difference in flood crests had it not been for the differences in the character of the distribution.

"Speaking in very general terms, a water cover of about 10 inches over the Mississippi basin from January to April, inclusive, will probably result in a more or less great flood from Cairo southward. The flood of 1927 did not exhaust the possibilities as to flood crests. Had the levees remained intact the stages in 1927 from Cairo to the Passes would have averaged a few feet higher than those recorded, and under the most favorable combination of contributory factors even still higher stages could occur."

The methods by which he has predicted disastrous floods of the Mississippi weeks in advance as told by Dr. Isaac M. Cline, in charge of the New Orleans Weather Bureau, were one of the features of the symposium.

The Mississippi has reached high stages more frequently in recent years than in times gone by, said Dr. Cline, even though the historic floods of 1782 and 1796 probably carried a greater volume of water than the flood of 1927. The reason for this is, he explained, that there has been great improvement in recent times to levee construction, which has held back the waters in the channel, that otherwise would have flowed over the land.

"Increase in the strength and height of levees has decreased the frequency of crevasses," Dr. Cline said, "but has increased the danger of disastrous overland floods from such breaks as occur, because of the increased head of water within the levees. Hence the forecasting of overland floods is of greater importance to the general public than is the forecasting of channel floods. Protection of life and property from overland flood waves requires a forecast of the rate of travel of the wave, and the closest approximation to the depth of water that may be expected at various points.

"The rate of travel is governed by the character and slope of the land. Overland floods in Louisiana have been found to travel at a rate of about 8 miles per day, air-line distances. In Mississippi the rate of travel is about 50 per cent. greater than in Louisiana.

"To forecast the depth of overland floods, topographic maps are absolutely essential. The first efforts at such a map for the Atchafalaya Basin was prepared by the Weather Bureau during the emergency in 1927, so that warnings could be issued for the overland flood following the Bayou des Claises crevasses. This information was also given to the U. S. Engineers and others who could make use of the information in helping the people out of the flooded area."

Science News-Letter, December 31, 1927

Storms Grow in Travel

How a great "cyclone" or general storm area, increases in size as it moves northeastward across the United States and Canada, or the western Atlantic, was described by Dr. W. J. Humphreys, of the U. S. Weather Bureau at Washington.

"As a general or cyclonic storm moves northeastward across the eastern United States and Canada," he said, "or over the Western Atlantic, it often increases rapidly in size and intensity. This storm consists of a swirl between cold air from the north on the northwestern side and warm humid air on the southeastern side.

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Storms Grow in Travel

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"As the storm moves farther north the cold side becomes still colder while the warm side changes but little in temperature owing to continuous condensation. Also in this part of the world, there are no high mountains to block off the free flow of either the cold air from the north or the warm humid air from the south. That is, as the storm moves northeastward the difference in temperature between its warm and cold sides increases, and the winds are but little obstructed. It therefore grows larger and stronger the farther it goes in this direction and in this region."

Dr. Humphreys also told why these storms increase faster by night than by day.

"In the eastern United States the northwestern portion of a general storm area is free, or nearly so, from clouds, and the southeastern cloud-covered," he explained. "The cloudy portion cannot cool much by radiation at night, while the clear portion can and does. Similarly, on the cloudy side very little heat gets through to the earth from the sun, while on the clear side there is abundant sunshine.

"Evidently, then, the temperature difference between the two sides of the storm becomes greater during the night and less through the day. But the intensity of the storm increases with this temperature contrast, hence, in the eastern United States, and in various places, the general or cyclonic storm grows faster by night than by day."

Science News-Letter, December 31, 1927

The population of Java has doubled in 25 years, a remarkable rate of increase.

Roots of the cat-tail plant are rich in starch and make nourishing food.

Records indicate that Indians of the Iroquois tribe obtained as high a yield in their crops as farmers of today.

BLACK WHITE or SPECKLED?

THE "COMMITTEE ON THE NEGRO"

organized for the anthropological and psychological studies on the American Negro published its first Anthropological paper in the *American Journal of Physical Anthropology,* Vol. X, No. 2. Dr. A. Hrdlicka, of the United States National Museum reviews this interesting and important subject and gives a bibliography of 269 titles.

Read the Anthropological paper on this great problem in the *American Journal of Physical Anthropology.*

Published by The Wistar Institute of Anatomy and Biology, Philadelphia.

Electrons Like X-Rays

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be explained by assuming it to be simply a wave motion. Then the quantum theory, in the hands of Planck, Einstein and A. H. Compton, showed that radiation had also to be regarded as having something corpuscular about it. Similarly, for many years electrons were believed to be simply corpuscles of negative electricity. But now recent developments in quantum theory, confirmed by these experiments, show that there is something wave-like about them."

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Impure Gelatine in Movies

The millons of dollars invested in the movies and the pleasure of the millions of people who daily attend them is based on chemical impurity in gelatine. This announcement, in effect, was made by Dr. C. E. K. Mees, director of the Research Laboratory of the Eastman Kodak Company.

"It has recently been found" said Dr. Mees, "that the sensitiveness of films is not due to the grains of silver bromide only but is in some way connected with the presence on those grains of specks of some other substance, and the Kodak Research Laboratories after a long and careful study have found that these specks are produced by an accidental impurity present in the gelatine. This impurity is derived from the plants eaten by the animals from whose skins the gelatine is made. There is only a very small amount of it in the gelatine, but it is a compound which contains sulphur, and when the gelatine is used for making the film, the sulphur reacts with the silver bromide and produces specks of silver sulphide on the crystals.

"In some way or other these specks increase the effectiveness of the light to which the film is exposed in the camera and enable the light to change the silver bromide so as to form a trace of metallic silver. Then this silver acts during developments as a nucleus on which more silver can deposit by the chemical process until the whole of the silver bromide crystal is turned into silver. Each of the original crystals of the film therefore after exposure to light becomes a grain of silver in the developed film, and it is of these grains of silver that the image projected on the screen is composed."

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Forty-Mile Hole for Power

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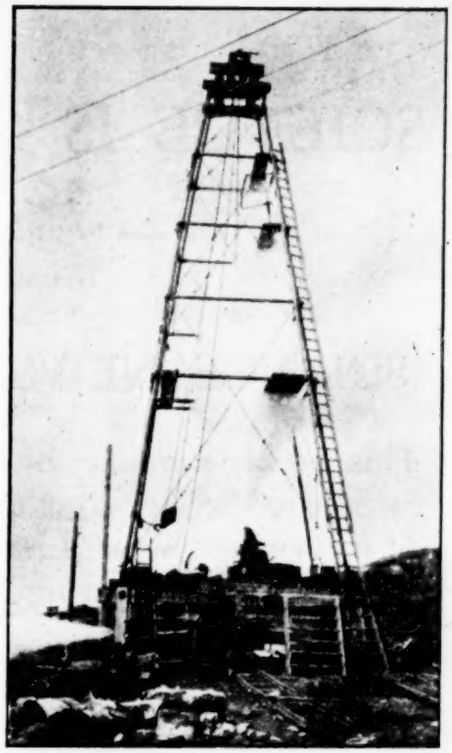
As the rock in the immediate neighborhood of the hole would give up its heat first, the yield would be greater at first. But even after 4,000 years, he estimates, the cooling would not have extended farther than 2,000 feet from the hole. If the hole were made larger, the yield would be somewhat increased, but the greatest advantage would come from making it deeper. Taking a hole 30 miles deep and a foot in diameter, an increase to ten feet in diameter would only increase the heat yield a third. But making it 40 miles deep instead of 30 would increase it about one and a half times.

Mr. Hodgson, as an engineer, has not been content with calculating what such a hole would do if we could dig it, but has actually worked out a scheme for making the hole!

Present mining methods make the limit of a hole by their use about 2 miles. Below that depth the pressures of the rocks become too great. But. Mr. Hodgson proposes a method of getting around this by something similar to hydraulic mining. Instead of using a stream of water to cut away the rocks, he suggests the use of a stream of molten metal—an alloy of aluminum. With this alloy, which has the same average density as the rocks it encounters, their pressure is balanced. Pebbles of quartz or flint carried by the liquid metal aid its work, while it is kept molten by electric circuits. When the desired depth has been reached the metal is removed and replaced by water.

Of course, since it is not even known whether the method would prove practicable, it is hard to estimate the cost of such a hole. However, he makes some rough comparisons of the cost of operation with that of an ordinary steam plant. An investment of about $2,500,000 at five per cent. would be required to yield 4,250 horsepower from coal at $5.00 per ton according to his estimate.

"The cost of a high temperature bore hole to produce the same amount of heat should scarcely be more than ten times this amount when the technique of making such bore holes has been adequately worked out," says Mr. Hodgson, "while the cost of the much shallower high temperature heat bore holes possible in volcanic areas should be able to compare very favorably with the cost of producing heat by any other method."



IF A DEEP BORE HOLE, such as is proposed by John L. Hodgson, British engineer, is ever made to utilize power from the earth, the top of it might look something like this. The installation shown here is at Lardarello, Italy, where Prince Ginori Conti has made use of natural steam as a source of power.

But the "high temperature" hole is not the only possibility. The engineer also proposes what he calls a "low temperature" hole. This consists of two bore holes, about 5 miles deep and connected by horizontal passages about 30 miles long. This 30 miles of horizontal passage, for the first 1,000 years, would produce an average of more than 4,250 horsepower, he believes. Such a system of holes, in his opinion, would not cost any more than ten times the cost of the present steam plant of like power. Then there is also the possibility of sinking it in regions where valuable ores are to be obtained and so reducing its cost indefinitely. Already a world shortage in such metals as zinc, tin and lead is in sight because all the pockets in which they occur within a mile of the surface are becoming exhausted.

With this system, a few workers would be required underground, and Mr. Hodgson suggests that they could be encased in heat proof suits through which air at about 60 degrees Fahrenheit circulated. This air could be obtained from tanks of liquid air either carried on trucks or by the workers themselves.

Apparently, then, our present methods of producing power are cheaper, but Mr. Hodgson's conclusion admirably summarizes the problem. This is what he says:

"We are, with regard to the problem of using the Earth's Internal heat, very much in the position of an eighteenth century 'outcropper' quarrying for coal in the hillsides of Yorkshire. Noting the dip of the strata, he could quite well reason that far below the surface there must be immense reserves of coal, which on the one hand he did not need to exploit because the hillside quarry provided for all his immediate needs, and which on the other he could see no possibility of exploiting at a profit because he knew nothing of such devices as the steam engine, the electric motor and the air compressor.

"Yet because the problem of making use of the deep lying coal seams was not lost sight of, men in Yorkshire today are mining coal thousands of feet below the surface by the methods and applications that were not even dreamed of by the 'outcropper' of two hundred years ago."

Science News-Letter, December 31, 1927

ZOOLOGY

The Hunters

Far in the north
  Wing through the night
Goblin-eyed owls
  Spectrally white.

Far in the south
  Saucer-fed snakes
Weave through the attics
  When the moon wakes.

Triune is death
  For the race of the rat—
Winged owl, scaled snake
  And velvet cat.

—*Elizabeth Coatsworth, in the New York Times.*

Science News-Letter, December 31, 1927

Aluminum was discovered just 102 years ago by Dr. Hans Christian Oersted, Danish physicist.

New York schools are experimenting with the use of moving picture reels to teach current events.

Travelers in the desert sometimes quench their thirst by drinking water stored by some of the desert plants.

The modern device of dressing sports contestants in different colors was a custom of the Romans.

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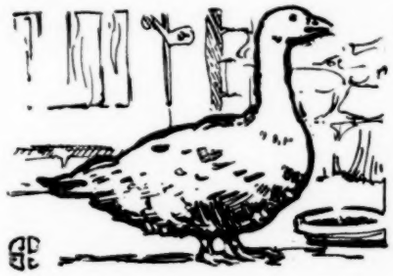
BIOLOGY

NATURE RAMBLINGS

By FRANK THONE



Holiday Goose

The Christmas holidays coming so soon after Thanksgiving, is rather hard on the poultry population. Many thousands of turkeys that escaped the late November massacre have lost their lives during the past few days and weeks.

Turkeys have been getting scarcer in this country of recent years, however, and the holiday goose is coming back into its own. Long before America was discovered, and with it the turkey, the goose held undisputed sway as the bird of the day at festal seasons. Even where turkeys are abundant there are many who prefer goose, for its flesh is moister and fatter than that of the American bird.

As the turkey is the most recent addition to the poultry yard, the goose was probably its first inhabitant, though possibly the duck might claim that honor. Both birds, as well as the common barnyard hen, were man's domestic companions long before the dawn of written history. The goose especially has had the esteem of primitive peoples, who dedicated it to one or another of their pagan gods. Even a nation of antiquity so recent and so civilized as Rome considered the goose sacred to Juno; the legend of the saving of the city by the alarmed cries of her flock at midnight is known to every one.

The goose is one of the most completely useable of all our domestic animals. Besides yielding a great lump of meat upon its involuntary demise, it gives us quantities of huge eggs before that event. It also supplies whole snowstorms of feathers and down for cushions and old-fashioned feather-beds, and can be plucked alive without apparent inconvenience. Finally, before the invention of metal pens, its quill-feathers made the best writing instruments; and before the invention of gunpowder those same stiff feathers winged the terrible clothyard shafts of the English archers. The goose, falsely defamed as a foolish bird, was the means of conquering a way to peace, writing the treaty, furnishing the feast of amity and celebration, and at last supplying soft beds for the King and his men to sleep on afterwards.

Is it any wonder that a bird which has been so useful to Christians should be a favorite at Christmas?

Science News-Letter, December 31, 1927

Katydid Concerts Timed

Katydids and crickets hear with their front legs. Such is the conclusion reached by Dr. B. B. Fulton of Iowa State College, after a close observation of prolonged vocal concerts participated in both by delegged insect songsters and those with the full complement of extremities.

There are on the front legs of certain insects of the grasshopper family, organs similar in structure to those used for hearing by higher animals, Dr. Fulton explained to the association. Only the species having stridulatory or singing organs possess also the tympanun organs on the foremost pair of legs. Whether they actually serve this purpose or not, however, is a matter of much entomological wrangling, as are the functions of most of the senses in insects.

Dr. Fulton staged his first demonstration with ten male katydids commonly found on the prairies, placed in a cage where night after night they exhibited "almost perfect synchronization."

"The song of the group was continuous," stated the entomologist, "and as each individual started its series of notes anew it would fall in with the general cadence. It was only by detecting slight variations in the quality and volume of the chorus that one could be aware of the pauses in the individual songs. After observing the song of the whole group for two nights I removed four males to another cage at some distance from the first and with a small scissors cut off their front tibiae close to the femora."

The notes from these mutilated insects were not synchronized except as they happened to sound together at times, Dr. Fulton declared. He repeated the experiment with crickets and a species of Nebraska grasshoppers with the same results. The removal of the front legs did not injure the insects' health in any way, he was careful to explain, for those operated on lived as long as those left intact. Grasshoppers frequently kick off one or both hind legs voluntarily to escape capture, he added.

Such a simultaneous sounding of notes as the uninjured insects produced can hardly be a matter of accident, said Dr. Fulton, and appears as conclusive evidence that they can hear each other.

Science News-Letter, December 31, 1927

Fox Disease Like Human Ill

Causes of the epidemics that take off hundreds of valuable silver foxes on the fox farms of the West are beginning to come to light. One form of the fox disorders that have been known generally and vaguely under the term distemper, has been shown by Dr. R. G. Green and a group of collaborators at the University of Minnesota, to have many of the characteristics of encephalitis, a contagious inflammation of the brain.

Deaths from a simple epidemic of this malady have totalled more than 700, Dr. Green told members of the Society of American Bacteriology. Typical cases show weakness, convulsions and a lethargic state. The onset is usually sudden, while the animal dies within from one to three days after it is taken sick. The mortality of the disease as it occurs in nature runs from 10 to 25 per cent., but cases infected artificially in the laboratory are almost inevitably fatal. The causative agent has not yet been found, though a specific streptococcus is under suspicion.

The action of this causative factor seems to be neutralized by castor oil soap. Animals vaccinated by means of a soap-virus mixture appear to have resistance to artiflcial infection, Dr. Green declared.

Fur farmers throughout the country and in Canada are bending every effort to prevent contagious diseases in their foxes, while Dr. J. E. Shillinger of the U. S. Biological Survey has been sent to cooperate with Dr. Green in the research at the University of Minnesota.

Science News-Letter, December 31, 1927

Ancient man discovered the four methods of preserving food, namely by drying, heating, freezing, and use of antiseptics, such as salt and smoke, long before the day of written documents.

In producing the perfume of the rose, chemists combine toluene, a coal tar distillate which smells like gasoline, with chlorine, a poison war gas, and treat it with another poison, potassium cyanide.

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Milk Sickness Poison

(*Continued from page* 403)

isolated compound "tremetol," after the old-time designation of the disease it caused, "trembles." It is soluble in fats and in chemical substances which will dissolve fats, such as petroleum ether. Because of this fat-soluble property, animals which have eaten the weed transmit the poison to their milk. Butter made from such milk is also poisonous.

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Classics of Science: Preparation of Carbon Dioxid

Priestley's illustration of the apparatus he used for making the first soda-water

In repeating the preparation of the first soda-water, the advantage of modern rubber tubing over that made from leather and sewed with waxed thread is obvious. Three sets of apparatus are offered by Priestley. That shown in Figure 3 is the most convenient today, but the others may be attempted by substituting rubber balloons for the bladders, which are not common now. The vessel holding the water to be impregnated with carbon dioxide held 3 pints (British); this is equivalent to 1.7 liters. For the 10-ounce phial substitute a 300 c. c. flask.

DIRECTIONS FOR IMPREGNATING WATER WITH FIXED AIR; In order to communicate to it the peculiar Spirit and Virtues of Pyrmont Water, and other Mineral Waters of a similar Nature. By Joseph Priestley, LL.D., F.R.S., London, 1772.

Directions

If water be only in contact with fixed air, it will begin to imbibe it, but the mixture is greatly accelerated by agitation, which is continually bringing fresh particles of air and water into contact. All that is necessary, therefore, to make this process expeditious and effectual, is first to procure a sufficient quantity of this fixed air, and then to contrive a method by which the air and water may be strongly agitated in the same vessel, without any danger of admitting the common air to them; and this is easily done by first filling any vessel with water, and introducing the fixed air to it, while it stands inverted in another vessel of water. That every part of the process may be as intelligible as possible, even to those who have no previous knowledge of the subject, I shall describe it very minutely, subjoining several remarks and observations relating to varieties in the process, and other things of a miscellaneous nature.

The Preparation

Take a glass vessel, *a*, fig. 1, with a pretty narrow neck, but so formed that it will stand upright with its mouth downwards, and, having filled it with water, lay a slip of clean paper, or thin pasteboard, upon it. Then, if they be pressed close together, the vessel may be turned upside down, without danger of admitting any, (or, however, much) common air into it; and when it is thus inverted, it must be placed in another vessel in the form of a bowl or bason, *b*, with a little water in it, so much as to permit the slip of paper or pasteboard to be withdrawn, and the end of the pipe *c* to be introduced.

This pipe must be flexible, and air tight, for which purpose it is, I believe, best made of leather, sewed with a waxed thread, in the manner used by shoe-makers. Into each end of this pipe a piece of a quill should be thrust, to keep them open, while one of them is introduced into the vessel of water, and the other into the bladder *d*, the opposite end of which is tied round a cork, which must be perforated, the hole being kept open by a quill; and the cork must fit a phial *e*, two-thirds of which should be filled with chalk just covered with water.

The Process

Things being thus prepared, and the phial containing the chalk and water being detached from the bladder, and the pipe also from the vessel of water; pour a little oil of vitriol upon the chalk and water; and having carefully pressed all the common air out of the bladder, put the cork into the bottle presently after the effervescence has begun. Also press the bladder once more after a little of the newly generated air has got into it, in order the more effectually to clear it of all the remains of the common air; and then introduce the end of the pipe into the mouth of the vessel of water, as in the drawing, and begin to agitate the chalk and water briskly. This will presently produce a considerable quantity of fixed air, which will distend the bladder; and this being pressed, the air will force its way through the pipe, and ascend into the vessel of water, the water, at the same time, descending, and coming into the bason.

When about one half of the water is forced out, let the operator lay his hand upon the uppermost part of the vessel, and shake it as briskly as he can, not to throw the water out of the bason; and in a few minutes the water will absorb the air; and taking its place, will nearly fill the vessel as at the first. Then shake the phial containing the chalk and water again, and force more air into the vessel, till, upon the whole, about an equal bulk of air has been thrown into it. Also shake the water as before, till no more of the air can be imbibed. As soon as this is perceived to be the case, the water is ready for use; and if it be not used immediately, should be put into a bottle as soon as possible, well corked, and cemented. It will keep however very well if the bottle be only well corked, and kept with the mouth downwards.

Joseph Priestley was born March 13, 1733 (old style), in Yorkshire, England, and died February 6, 1804, at Northumberland, Pennsylvania, U. S. A. As a child his studies included geometry, algebra, natural philosophy, and modern languages, and the rudiments of Latin, Greek, and Hebrew. At nineteen he was sent to Daventry as a non-conformist divinity student, where he stayed three years. In 1761 he became professor of belles lettres at the academy at Warrington, and remained there six years. While there he wrote a History of the Discoveries in Electricity, received an honorary LL.D. from Edinburgh, and became a member of the Royal Society. He left the school for financial reasons and returned to preaching at Leeds, but there he also found time to continue his scientific work. He remained there from 1767 to 1773, then went to live with his patron, the marquis of Lansdowne until 1780. During those years, when he was between the ages of 34 and 47, Priestley carried on his researches on various kinds of "airs" or gases. After that he resided at Birmingham, where he enjoyed the friendship of James Watt, Erasmus Darwin, and other scientific leaders of the time. But Priestley had not risen to fame without making enemies, partly on religious, partly on political grounds, and in 1791 a mob chose the occasion of a celebration of the anniversary of the fall of the Bastile, with which he had little to do, to burn his chapel, destroy his house, and drive him and his family out of the town. He was invited to take charge of an appreciative congregation at Hackney, where he stayed until, in 1794, he decided to join his sons who had gone to America, or, as a contemporary writer put it, "to retire as an exile to the remotest limit of the civilized world."

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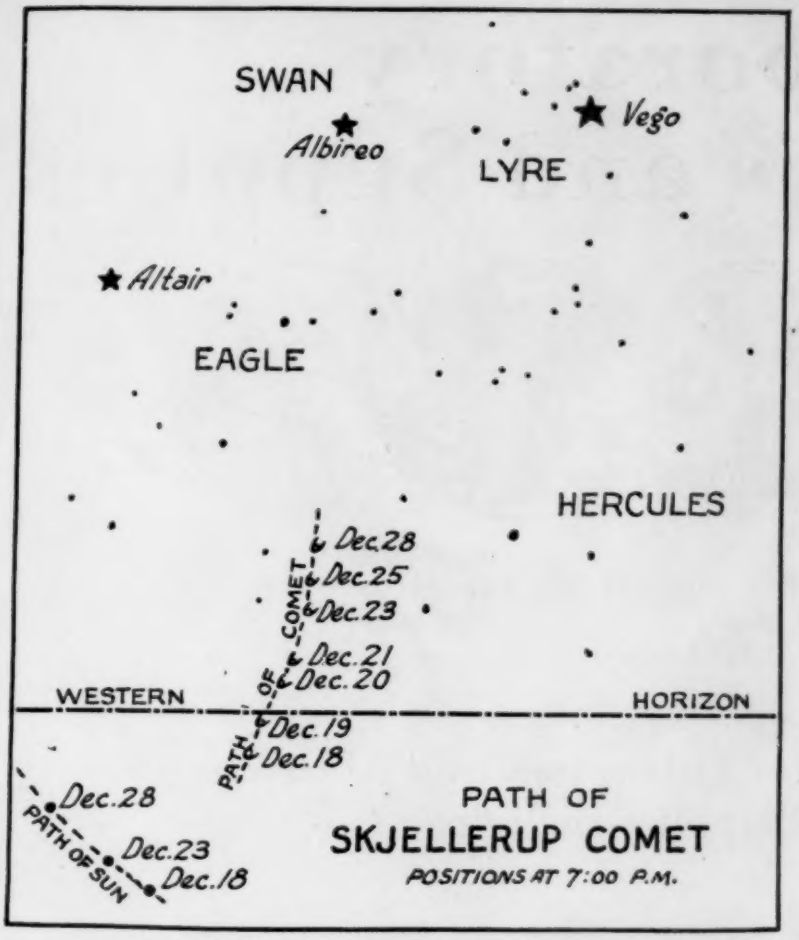
ASTRONOMY

New Comet Seen by Astronomers



Though later calculations of the path of the new Skjellerup comet have revealed that it is behind the schedule first set for it, several American observers have seen it. Following the first observations by daylight from the Lowell Observatory at Flagstaff, Arizona, it was seen from the Students' Observatory of the University of California, the U. S. Naval Observatory at Washington, and the Yeskes Observatory of the University of Chicago.

On the basis of the latest observations, Leland E. Cunningham of the Harvard College Observatory at Cambridge, Mass., has computed a new ephemeris, as the astronomer calls the comet's time-table, from which the above map is drawn. It is continuing to move in a northerly direction towards the bright star Vega, in the constellation of Lyra, the Lyre, which shines brilliantly low in the northeast now in the early evening. As the comet is still fairly bright, it should be visible for several weeks in the western evening sky after sunset, as a faint patch of light.

The suggestion has been made by A. C. Crommelin, of the British Royal Observatory, that the Skjellerup comet may be the same as De-Vico's comet, which came near the earth in 1846, being number four of that year. He made this suggestion just after the discovery of the new visitor, stating that if this were the case the date of perihelion, when it came nearest the sun, would be December 15. It has turned out very close to this—December 18.

An attempt to observe the comet by the naked eye in daylight from an airplane was unsuccessful when James Stokley, astronomer on the staff of Science Service, made a flight in an Army airplane on Saturday, December 17. Because of the haze near the ground, which obscured the comet, it was thought that an airplane would be able to surmount the haze. An altitude of ten thousand feet was attained. This was higher than the low haze, but a much higher layer still made so much glare near the sun that the comet could not be observed. The flight was made in a Curtis O1 observation plane from Bolling Field, Washington, with Lieut. F. O. Dice as pilot.

Science News-Letter, December 24, 1927

PLANT PHYSIOLOGY

Leaves Uneven Workers

Leaves have long since been convicted of being inefficient workers, utilizing only one or two per cent. of the total sunlight energy they receive. Now they are shown to be very temperamental and uneven in their use of even that pittance, by two Russian plant physiologists, Dr. N. A. Maximow and Dr. T. A. Krasnosselsky-Maximow.

In their experiment leaves of different plants, such as barley, soy beans, buckwheat and millet, were put into flat glass containers without being detached from their parent plants. Air was sucked through the containers, and analyzed as it entered and as it left, to determine how much of the useful carbon dioxid the leaves were extracting from it to manufacture into food. The apparatus was so arranged that determinations could be made in a continuous series making possible a close check on the work of the leaves.

The experiments showed that the intensity of carbon dioxid assimilation, even in such short intervals of time as twenty or thirty minutes, never remains constant. Decreases and increases of as much as 40 per cent. in the rate of intake occurred during a single run of determinations.

The Maximows do not offer an explanation of the fluctuations in the efficiency of leaves as food-making machines. They are sure that the changes are not due to outside causes, but have not yet determined what the internal factors may be. They conjecture, however, that it may be connected with a rhythmic opening and closing of the stomata, or breathing-pores, of the leaves.

Science News-Letter, December 24, 1927

ANATOMY

Lenin Had Genius Brain

The brain of Nikolai Lenin, examined by request of the Soviet government, shows marked characteristics of genius, Prof. Oscar Vogt, director of the Kaiser Wilhelm Institute for Brain Research, has announced.

Professor Vogt found in the Russian leader's brain evidence to support the theory that certain parts of the brain govern certain specific mental functions. This theory has lately been attacked by experiments performed on apes, indicating that if one area of the gray matter is destroyed another may take up its work. Two hundred fields of localization were found in the brain of Lenin.

Science News-Letter, December 24, 1927

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Know Your Christmas Tree

In summer, when all the woods are green, most of us pass the evergreen trees by, to commune with their broad-leaved brethren. Somehow the evergreens, in their heavy robes of dark needles, seem less friendly, less human, more austere than the others. Even the wandering breezes, that set the leaves of maple or poplar to whispering and chattering, only move these reserved old trees to mysterious-sounding murmurs. Longfellow caught their spirit exactly when he likened them to "Druids of eld."

But as Christmas approaches, and our lighter friends of the warmer weather stand like stripped and shivering skeletons, the pines and the hemlocks have their day. Even a Druid is friendlier than a ghost, the more so when he hides among his garments pleasant surprises of siskins and grosbeaks, coaxed to his arms by promise of shelter from the winds and a meal of seeds. We lose a little of our unconscious awe, and become more willing to improve our acquaintance.

There are numbers of evergreen trees to be met with in the course of an afternoon's walk in bright cold Christmas weather, whether one has access to native timber or to cultivated trees in a city park or on suburban lawns. Many of us find ourselves embarrassed in the presence of our Christmas trees, as we do when we essay to introduce a couple of friends and suddenly discover that we cannot remember their names. "I know they are evergreens, but I can't tell them apart," is a common experience.

Yet it is comparatively easy to learn the trick. There are, after all, not very many distinct groups of evergreen trees, and unless one is anxious to get the last fine details of specific distinctions, and hold up his head among professional botanists, he can learn the broad outlines and be able to distinguish the commoner kinds in the course of a single afternoon's ramble. The only thing one needs do is look a little more closely than usual at leaves and bark and cones, and remember a fact or two in connection with each variety.

Pines, though not the favorite Christmas trees, are still widely used, especially in the South. The thing to remember about pines is that their leaves or needles are always found in pairs or little clusters, and that their cones are usually comparatively large, with thick, heavy scales. If the needles are borne singly, or the cones have thin scales, the tree isn't a pine. Among the pines there are two main

Twigs of three conifers much used as Christmas trees: Upper, Spruce; middle, Balsam Fir; lower, Hemlock Fir

groups, the white pines and the yellow. White pines always have their moderately long, rather soft needles in bunches of five; with one unimportant exception the yellow pines never have their needles so arranged. Yellow pine needles usually come in twos, though sometimes in threes or fours. There is only one white pine that is at all common but the yellow pine group is very numerous and includes such trees as the Scotch pine, the jack pine and the long-leaf pine of the South.

The trees most widely used for Christmas purposes in this country are the spruces and firs; in Germany, where Christmas trees originated, the favorite is the hemlock. All of these trees bear their leaves singly, instead of in bunches, as the pines do. Spruces and firs can be further identified by their moderate sized thin-scaled cones, while the cones of the hemlock are very tiny. The spruce has hard, stiff, four-sided prickly leaves that stand out about equally on all sides of the twigs, and its cones hang *down*. There are two or three native spruces in common cultivation, and one very fine imported one, the Norway spruce, notable for its big cones. The fir has softer, flatter leaves, that are so bent at their bases as to form two rows or ranks, and its cones always stand *up*. Bark and cones and needles of the spruce are frequently smeared with exudations of a very sticky resin, which give the tree its other name of "balsam."

The third tree of the spruce-fir triumvirate is a sort of botanical orphan. It is commonly called Douglas fir and sometimes Douglas spruce; but it is neither spruce nor fir. Its lumber is often sold under the name of pine, but it is not a pine. Its technical name is "Pseudotsuga," which is an outlandish combination of a Greek and a Japanese word, meaning "false hemlock," but it is not at all like a hemlock. The poor thing simply hasn't any proper name to call its own. And it is a very proper tree, too. Out in its native Northwest, where trees are trees, its trunks measure in feet what the common forest specimens of the East measure in inches. It would be hard to distinguish from spruce and fir by its foliage alone, for it is about intermediate between them, having needles stiffer than those of the fir but softer than those of spruce. But its cones offer a sure and easy means of identification. Projecting over each scale is a three-pointed appendage or bract which is the unique mark and stigma of the Douglas fir. No other tree has anything resembling it.

The original Christmas tree, famous in song in the land where Christmas is not Christmas without it, is the hemlock. This is the "Tannenbaum" of which the German children sing, and was the sacred tree of the pagan German midwinter feast that was the predecessor of Christmas in the northern lands. It may be known by its very short leaves, ranged in a two-ranked order down the sides of the twigs, and by its very tiny cones. Unlike the other evergreens, it consorts with the climax broadleaf forest on terms of equality. The most magnificent woods this continent ever knew were the beach-maple-hemlock forests of lower Michigan, now, alas, practically wiped out. In them the hemlock was an integral part; other evergreens, in other places, are trees of the rocky places and swamps and burnt-over areas—pioneer trees, hardy and tough and competent to wrest a living from the slenderest resources but unable to face the competition of the faster-growing broad-leaved trees when these invade their stand. The hemlock, therefore, merits special homage.

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Indian culture that centered at Etowah, Georgia, were donated to a number of American museums by Prof. Warren K. Moorehead of Phillips Academy, Andover, Mass.

German autopsies on 30,000 Egyptian mummies showed that decayed teeth increased progressiely as the Egyptians became more civilized and that syphilis was practically non-existent in ancient Egypt.

The trail of ancient man in the far northwest was followed by ethnologists of the Smithsonian Institution, who collected material from old burials and studied customs in Alaska.

The "Burnt Rock" mounds in Texas were found to contain records of three prehistoric Indian civilizations.

Skeletons of the transition period at the time when prehistoric Indians of the Southwest changed from the basket-making age to the pottery-making age were found at Chaco Canyon, New Mexico.

Bones of extinct animals discovered together with stone implements in Oklahoma, Texas, and New Mexico, were examined by a number of scientists who declared that they indicate the existence of man on this continent during the glacial period.

The theory that clothing was first adopted by primitive men chiefly as a protection against insects, was advanced by Dr. Knight Dunlap, professor of psychology at Johns Hopkins University.

The Huxley Memorial Medal of the Royal Anthropological Society was presented to Dr. Ales Hrdlicka, anthropologist of the U. S. National Museum.

Astronomy

An amateur astronomer named Blathwayt, at Braamfontein, South Africa, discovered a new comet on January 13.

An amateur astromer, William Reid of Rondebosch, South Africa, discovered a new comet on January 26.

The Pons-Winnecke comet, which made one of its sexennial visits to the earth's neighborhood, was detected on March 3 by Dr. George Van Biesbroeck, of the Yerkes Observatory, Williams Bay, Wis. It came within 3,500,000 miles of the earth on June 27, closer, with one exception, than any comet had been known to come in the past.

A new comet was discovered on March 10 by Dr. Carl L. Stearns of the Van Vleck Observatory of Connecticut Wesleyan University.

The Grigg-Skjellerup comet was discovered on March 30 by Dr. George Van Biesbroeck, of the Yerkes Observatory.

An Australian justice of the peace and amateur astronomer, Walter F. Gale, discovered a new comet on June 7.

Schaumasse's periodic comet was observed on its return on October 4 by Prof. Van Biesbroeck, of the Yerkes Observatory, and possibly by Gerald Merton, of the British Royal Observatory a little earlier.

Encke's comet, a periodic visitor, was found on November 12, as it came near the earth again, by Prof. George Van Biesbroeck, of the Yerkes Observatory.

A naked eye comet visible in both the northern and southern hemispheres was discovered December 3 by J. F. Skjellerup, Australian amateur, and was visible just before Christmas.

A new star was located in the Milky Way by Dr. Max Wolf, of the Heidelberg Observatory in Germany.

A comet and a nova, or new star, were discovered within three days by two German astronomers, Drs. A. Schwassman and Wachmann.

Prof. Joel Stebbins of the University of Wisconsin announced the discovery that the satellites of Jupiter always keep the same side turned toward their parent planet, just as the moon does toward the earth.

An eclipse of the sun on June 29, visible in England and Norway, was seen at certain points along the path of totality by astronomers from the British Royal Observatory and the Hamburg Observatory in Germany though American astronomers in Norway were unable to see any of it on account of cloudy weather.

The aid of the Canadian Mounted Police, Catholic missionaries to the Eskimos, fur trappers and others was asked by Dr. Willard J. Fisher, of the Harvard College Observatory, in observing the total eclipse of the moon on June 15.

Discovery of just how the solar radiation varies was announced by Dr. C. G. Abbot, of the Smithsonian Institution.

Many large sunspots were observed, and magnetic storms on the earth took place in apparent conjunction with them.

The possibility that stars may be liquid was advanced by Prof. J. H. Jeans, English astronomer.

Basalt, a rock common on the earth, is not present on the surface of the moon, Dr. Fred E. Wright, of the Carnegie Institution, told members of the National Academy of Sciences, in reporting a series of studies he had made with a new instrument.

The sun and the nearby stars may be in a vast cloud of cosmic "dust," said Prof. Edward S. King, of Harvard Observatory, thus causing the more distant stars to appear redder than the nearer ones, an effect that has actually been observed.

The radius of the universe was estimated as one hundred million light years by Prof. E. T. Whitaker of Edinburg University, in a report to the British Association for the Advancement of Science.

In the hands of amateur astronomers in all parts of the world, his invention, the spectrohelioscope, may go far towards solving outstanding solar mysteries, Dr. George Ellery Hale, honorary director of the Mt. Wilson Observatory, declared.

A 60-inch reflecting telescope, the largest in the southern hemisphere and the third largest in the world, was ordered for the new South African station of the Harvard College Observatory, which will replace the former station at Arequipa, Peru.

The solar wave lengths in the unexplored regions of the spectrum were mapped by the U. S. Bureau of Standards in cooperation with Allegheny Observatory.

The largest disk of optical glass ever cast in the United States was made by the U. S. Bureau of Standards, the reflecting telescope blank being of borosilicate crown glass, 70 inches in diameter and 12½ inches thick.

Biology

A ten-million-dollar war was waged against the European corn borer in the Corn Belt states by the Department of Agriculture and declared successful.

Three botanists, Dr. A. B. Stout, Dr. Ralph McKee and E. J. Schreiner announced the development of a fast-growing hybrid poplar to meet the demands for wood pulp.

Cells, usually assumed to be short-lived, were found still living in the heartwood of redwood trees a century old, it was reported by Dr. D. T. MacDougal, of the Carnegie Institution of Washington, and Dr. G. M. Smith, of Stanford University.

The Tennessee State Supreme Court, in a decision on appeal in the famous Scopes case, declared the anti-evolution law constitutional, but so worded its decision as virtually to nullify the law. John Scopes was excused from paying the fine levied against him for violating the statute, because of an error on the part of the judge presiding at his trial.

Efforts made in thirteen states to pass anti-evolution statutes were unsuccessful.

X-rays applied to the reproductive cells of animals and plants were found to speed up the rate of evolutionary change over a thousand per cent. This work was done on fruit flies by Prof. H. J. Muller of the University of Texas and on tobacco plants by Prof. T. H. Goodspeed and Prof. A. R. Olson of the University of California. Numerous other invesitgators are now actively engaged in research on the biological effects of X-rays.

Natural evolutionary changes in shell fish within 60 years, producing distinctly recognizable animal varieties in a lake in Wisconsin, were reported by Dr. Frank C. Baker, curator of the museum of natural history of the University of Illinois.

Chemical affinities between the milks of related animals were discovered by Prof. H. R. Marston of the University of Adelaide.

Eggs of the marine worm, Nereis, were fertilized without fathers, by the use of an electric current, in the laboratory of Dr. Ware Cattell of Memorial Hospital, New York City.

Dr. Barnett Sure of the University of Arkansas has shown by experiments with rats that a poorly nourished mother, whose bodily stock of vitamin B is subnormal, becomes unable to pass along this necessary food element to her nursing offspring.

The female sex hormone, or gland essence that causes typically feminine reactions and development in animals, was discovered in male animals as well as female, by Dr. Otfried O. Fellner of Vienna.

The tuberculin testing of fowls to weed out avian tuberculosis was advocated by Dr. John R. Mohler, chief of the U. S. Bureau of Animal Industry, at the Third International Poultry congress held at Ottawa, Canada.

Mathematic studies of athletic records show that the one for the 880-yard run should be most easily broken, Dr. Earle R. Hedrick, of the University of California, stated.

Dr. Raymond Pearl, director of the Institute for Biological Research at the Johns Hopkins University, announced a theory based on laboratory observation of yeast, bacteria and fruit flies, that biological and human populations rise and fall in accordance with a universal law.

Congress passed a bill to provide for the collection and care of a herd of the nearly extinct Texas longhorn cattle, in the Wichita National Forest, Oklahoma.

A program for the scientific study and administration of the great elk herds of the Yellowstone region was planned by a cooperative committee of the national, state and private bodies interested.

The first International Congress of Soil Science was held in Washington in June and attracted scientists from many foreign countries.

A serious plague of mice occurred in Kern County, Calif., during January and February.

(*Just turn the page*)

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A new mosquito poison based on formaldehyde and said to be the most efficient yet devised, was announced by E. Boubaud of the Pasteur Institute of Paris.

Rediscovery of the straight-billed reed runner, a bird of Uruguay first noted by Darwin in 1831, of which all trace had been lost for nearly 100 years, was made by C. C. Sanborn, of the Captain Marshall Field South American Expedition, of the Field Museum.

Chemistry

Experiments by H. S. Cooper of Cleveland, Ohio, showed that the light-weight metal beryllium or its alloys is suitable for airship frames and light-weight pistons.

The new chemical element rhenium was obtained in pure form by its original discoverers, Drs. Walter and Ida Noddack.

Metallic vanadium was obtained for the first time by J. W. Marden and M. N. Rich, of the Westinghouse Lamp Co.

A record making deposit of borax, in the form of a new mineral called rasorite, was discovered in California by C. M. Rasor.

Prof. David I. Macht of Johns Hopkins University announced that polarized light speeded the growth of certain plants, and had other effects on life.

That the germs of tuberculosis contain a previously unknown compound, a phosphorous-containing fat, was discovered by Prof. R. J. Anderson, of Yale University.

Making of synthetic rubber from coal on a commercial scale was announced by the German chemical trust.

Electroplating of rubber from latex or colloidal solutions of rubber was developed upon an industrial scale.

Hydrogenation of coal to produce liquid fuels resembling petroleum reached the point of commercial application.

Progress in the further synthesis of chemicals from cheap raw materials was made.

Cornstalks were utilized experimentally as a source of cellulose for paper and artificial silk.

New denaturants for alcohol were developed, some of them being produced by synthesis from petroleum products.

The U. S. Bureau of Standards discovered that duralumin can be protected against corrosion by coating with pure aluminum.

Engineering

The U. S. Army developed a new fire-control instrument for anti-aircraft artillery, which makes it possible for one man to aim any desired number of guns.

A new 3-inch anti-aircraft gun firing 15-pound shells at the rate of about one every two seconds was developed by the U. S. Army.

The six-mile Moffat tunnel under James Peak, Colo., was completed.

The Holland vehicular tunnel between New Jersey and New York City was opened to traffic.

The United States Steel Corporation inaugurated an extensive program of research into the fundamental problems of the industry.

A device for detecting one part of mercury in 20,000,000 parts of the atmosphere was developed by the General Electric Company.

Diphenyl oxide, a white chemical with a powerful odor like geraniums, was experimented with as a substitute for water in steam boilers, in an endeavor to increase their efficiency.

More durable paper currency resulting from tests of the U. S. Bureau of Standards resulted in estimated savings of one million dollars a year.

An acoustical plaster which absorbs most of the sound falling upon it was developed by the U. S. Bureau of Standards.

Methods of making low-cost roads of gravel sand and clay were developed.

Geology and Geography

Scientists of 25 nations, meeting at Prague, passed resolutions recommending an international cooperative study of ocean deeps.

Floods in the lower Mississippi Valley and in New England were the worst that had ever been recorded.

That the Mississippi floods may be due to the gradual sinking of the lower valley of the river, closer and closer to sea-level, was suggested by Dr. David E. White, eminent geologist of the National Research Council and the U. S. Geological Survey.

Disastrous tornadoes struck Louisiana, Mississippi, Texas, Oklahoma, Illinois, Arkansas, Kansas, Missouri and Washington, D. C. St. Louis was particularly damaged.

Large quantities of oil may be deposited below the bottom of the sea, said Dr. Parker D. Trask, of the American Petroleum Institute.

Discoveries of potash salts in Texas and New Mexico thick and rich enough for mines were discovered through test boring made by the U. S. Geological survey.

Seven thousand square miles in southeastern Alaska were surveyed by aerial mapping through the cooperation of the Navy and the U. S. Geological Survey.

Two large areas in Alaska totaling 7,800 square miles, were explored by scientists of the U. S. Geological Survey, discovering and mapping a high mountain region hitherto unknown and finding a volcano in eruption.

A great earthquake on May 22 in the Kansu province in interior China was announced to the world on the following day by Science Service, in cooperation with the U. S. Coast and Geodetic Survey and the Jesuit Seismological Association, though it was not for many weeks later that actual reports from the devastated region reached civilization.

Other severe earthquakes during the year that were immediately located by the cooperation of these three bodies included those in Chile, April 14 and November 14, Japan, March 27; Alaska, October 24 and California on November 4.

The heat of Kilauea, the world's largest volcano, was measured by means of borings made in its floor by Dr. T. A. Jaggar, director of the Hawaii Volcano Observatory.

Medicine

The 1927 Nobel prize for medicine was awarded Prof. Julius Wagner-Jauregg of Vienna for his treatment of paresis by inoculation with malaria.

Cancer in the chicken can be rendered inactive by small quantities of aluminum and calcium salts, Mrs. Margaret R. Lewis and Dr. Howard B. Andervont discovered.

A "heart hormone," or internal secretion that stimulates the heart to keep it beating, was discovered by Dr. Ludwig Haberlandt of the University of Innsbruck.

Thyroxin, the hormone of the thyroid gland, was made synthetically in the laboratory of University College, London, by C. R. Harington and Prof. George Barger. Dr. C. R. Harington and Prof. George Barger.

Dr. J. J. Abel of the Johns Hopkins University has prepared a crystalline insulin

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Scientific Advances, 1927

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which appears to be a pure hormone necessary for the maintenance of normal sugar metabolism.

"Synthalin," a German preparation designed to supplement or replace insulin in the treatment of diabetes, was at first widely hailed, but proved a disappointment.

Discovery of a new drug, "myrtillin," as a valuable treatment for diabetes was announced to the American Medical Association, by Dr. Frederick M. Allen, of Morristown, N. J.

Liver extract can be used to cure pernicious anemia, Drs. George R. Minot, William P. Murphy and E. J. Cohn, of Harvard University, announced; also the latter extracted from liver an extract which produces red corpuscles and probably is the active ingredient.

A diet that simulates a condition in the body brought about by starvation, has been found by Drs. F. B. Talbot, K. M. Metcalf, and Margaret E. Moriarty at the Massachusetts General Hospital in Boston to give successful results in treating epileptic children.

Vitamin C, the substance that wards off scurvy, is present in milk as well as in the fresh vegetables usually relied on to supply it, was the report by Prof. L. F. Meyer, following extensive experiments at the University of Berlin.

Ergosterol was declared to be the really active and essential substance in the antirachitic vitamin, by a number of investigators working independently of each other.

Dr. Alfred F. Hess of New York reported that dried milk that has been treated with ultra violet light is the most practical of the irradiated foods that have been used to prevent rickets in babies.

Preventive vaccination for smallpox and typhoid, large quantities of quinine and elaborate mosquito control measures contributed to checking outbreaks of disease epidemics in the South after the Mississippi flood.

Drs. E. G. Wakefield and W. W. Hall of the U. S. Navy Medical Corps completed a systematic survey of heat injuries and one of the first investigations into the physiological reactions underlying sunstroke.

Scientists at Berlin have showed that it is possible to change simple embryonic tissues into malignant tissue by exposing the former in tissue cultures to the action of arsenic.

Discovery of the germ causing trachoma, a serious disease of the eye that has been especially troublesome among the Indians, was announced by Dr. Hideyo Noguchi, of the Rockefeller Institute, New York.

A curative antitoxin for erysipelas, first developed by Dr. K. E. Birkhaug, of Rochester, N. Y., has been tried out with highly successful results at the Bellevue Hospital in New York, which has one of the largest clinics in the world.

Streptococcus germs isolated from skin lesions of erysipelas are capable of causing sore throat without any skin affection, it was found by Drs. George F. and Gladys H. Dick, at the John McCormick Institute for Infectious Diseases.

Progress in the work of developing a serum to fight the African sleeping sickness was announced by Dr. William H. Taliafero, of the University of Chicago.

A color test for tetanus and diptheria toxins has been worked out by Drs. Lucy Mishulow and Charles Krumwiede of the New York City Health Department, that will greatly speed up the commercial production of these products. Hitherto toxins have had to be tested out on live guinea pigs, a time consuming and not altogether accurate procedure.

Dr. Florence B. Seibert of the University of Chicago has produced an active protein in crystalline form which represents a step nearer the solution of the actual chemical nature of tuberculin.

Statistical evidence that the first born child in a family is more likely to have certain malformations of mind and body than later children, and that such malformations are not likely to recur in later births in the same family, was presented by Dr. G. F. Still, professor of children's diseases at King's College, London.

The utility of X-ray photographs of the head as a positive means of identification was demonstrated by Drs. William L. Culbert and Frederick M. Law, of New York, when they identified an unknown body with their aid.

Heart disease occurs less frequently in children who have had their tonsils removed than in those who have not, said Dr. A. D. Kaiser, of Rochester, N. Y., before the American Medical Association.

An extract from the liver of dogs that will keep blood from clotting was discovered by Dr. W. H. Howell, of Johns Hopkins University.

A new anesthetic known as avertin that lacks many of the undesirable features of the anesthetics now in use, is being tried out in German hospitals.

A new and accurate chemical test for drunkenness, by which the subject's breath is passed through a chemical solution, was demonstrated to the American Medical Association by Dr. Emile Bogen, of the University of Cincinnati.

The Metropolitan Life Insurance Company announced that their statistics showed that America has had more deaths from alcoholism since Prohibition than before.

Physics

A new theory of the mechanics of atoms was enunciated by the Swiss physicist, Schrodinger, which, in brief, holds that electrons and other units of matter are wave systems like ordinary light and X-rays.

The 1927 Nobel prize for physics was awarded jointly to Prof. Arthur H. Compton of the University of Chicago and Dr. C. T. R. Wilson of Cambridge University, England, for their researches on X-rays and radium radiation.

The tercentennial of the death of Isaac Newton was celebrated by scientists all over the world.

Dr. Dayton C. Miller of the Case School of Applied Science at Cleveland, Ohio, repeated experiments that may show that the earth is drifting through the ether.

Sound waves vibrating far too rapidly to be heard produced such curious effects as the emulsion of a candle in water, Prof. R. W. Wood, of Johns Hopkins University said, in describing to the National Academy of Sciences work which he had performed in collaboration with Alfred L. Loomis.

Cathode rays from the tube recently invented by Dr. W. D. Coolidge of the Research Laboratory of the General Electric Company have been found to be like sunlight in their power to give certain substances the quality of preventing rickets.

An instrument known as the thermionic microammeter, able to measure one five-billionth of an ampere, was developed by the laboratory of the General Electric Company at Lynn, Mass.

The grid glow relay, invention of D. D. Knowles, Westinghouse engineer, which operates on a billionth of a watt of electrical power, was demonstrated.

Discovery of a new electrical insulator was announced by Dr. Abram Joffe, a Russian scientist visiting the United States.

A highly successful process of television, by wire and radio, the development of the Bell Laboratory under the direction of Dr. Herbert E. Ives, was demonstrated on April 7.

The televox, an apparatus by which the telephoned note of a tuning fork can be used to extinguish lights, start and stop electric fans, and operate other devices, was exhibited by its inventor, R. J. Wensley.

The non-magnetic ship Carnegie was overhauled preparatory to a lengthy scientific cruise to begin next year.

Metal shrinks when it is magnetized, Prof. S. R. Williams of Amherst College stated.

The conclusion that nebulium, the strange "element" supposed to exist in such bodies as the great cloud of glowing gas in the star group of Orion, is merely oxygen and nitrogen, was reached by Dr. I. S. Bowen, of the Norman Bridge Laboratory of Physics.

Dr. Paul R. Heyl, of the U. S. Bureau of Standards announced the determination after three years work of the Newtonian constant of gravitation as the fraction 6.664 over a hundred million; a value ten times more accurate than the previously accepted value.

The "quantum," the "atom" of which modern physicists suppose that light and other radiations consists, may be divided, was indicated by experiments by Dr. A. J. Dempster, of the University of Chicago.

The wind velocity of the hurricane that wrecked Miami on September 18, 1926, was determined as 132 miles an hour, which was declared the highest on record by Benjamin C. Kadel of the Washington, D. C., weather bureau.

Psychology

Statistics from Massachusetts, the first state to round up its entire new generation of feebleminded in order to develop them into useful citizens, reveal the great number of such children now being wasted, Dr. Neil A. Dayton of the Massachusetts Department of Mental Diseases reported.

The experiment of caring for mental patients in a general hospital has been tried and found successful, and this method of care has many advantages, Dr. Thomas J. Heldt, of the Henry Ford Hospital in Detroit, reported.

Environment rather than heredity was shown to be the great cause of insanity according to a fifteen-year investigation of 28,000 individuals who died on Cape Cod in the past fifty years, reported by Dr. L. Vernon Briggs, psychiatrist.

American Psychiatric Association advocated adoption of laws to put the psychiatrist in court in the position of counselling the legal authorities as to the sanity and disposal of social offenders.

Tests to determine whether prospective school teachers will make good in the school room or not, were devised and put to use by Prof. F. A. Moss and his assistants at the psychology department of George Washington University.

Dr. Knight Dunlap, professor of psychology at the Johns Hopkins University, reported experiments that indicate the mouth is a more expressive feature of the face than the eyes.

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First Glances at New Books

THE KINGDOM OF THE MIND—June E. Downey—*Macmillan* ($2).

This might be called a "cafeteria psychology." The reader waits on himself. He gets more fun than having everything served to him while he sits still and swallows it. Also he learns more that way. In fact the only way to learn anything really is to do it yourself. Especially anything about yourself.

Here are simple practical tests by which a boy can find out how to improve his game, however good that is. How a girl can find out how to improve her temper, however bad that is. How to test the accuracy of your senses and the quickness of your reaction time and the retentiveness of your memory and the originality of your imagination; in short how to inventory your mental stock in trade on which your future fortune depends.

This is the third volume of "The Young People's Shelf of Science," edited by Science Service to carry sound science to folks in their teens, but folks of several teens can profit by them.

Science News-Letter, December 24, 1927

I. APES AND MEN. II. HUNTERS AND ARTISTS. III. PEASANTS AND POTTERS—Harold Peake and John Fleure—*Yale University Press* ($2 each). These three volumes are the first of a series of eight, published under the series title, The Corridors of Time. This initial triad carries the story of primitive man from his earliest beginnings down through the New Stone Age. The series as projected will carry through to the beginnings of Greece and Rome. The books are written in an excellently clear style and the illustrations are pertinent and well made. Best of all, the authors have kept clear of the facile dogmatism into which it seems to be so easy to fall when writing the history of men who left no history.

Science News-Letter, December 24, 1927

THE NATURE ALMANAC—Arthur Newton Pack and E. Laurence Palmer—*American Nature Association* ($1). Compacted into this manual is a great mass of information on nature study associations, courses and teachers all over the country. A comprehensive series of nature book bibliographies is an especially valuable feature.

Science News-Letter, December 24, 1927

GENERAL SCIENCE

New Books In Science

Industrial progress is largely dependent upon science; and scientific and technical workers—whether engaged in research or in industrial pursuits—find their endeavors greatly facilitated by the published records of results attained by other workers. It is thus essential that scientific and technical men be kept informed regarding new books in their respective fields.

The Publishers' Weekly, the American Book Trade Journal, gives prompt notice of new books published in the United States, merely listing books of all classes, alphabetically by names of authors.

The Cumulative Book Index supplements the above service by arranging books by authors, titles, and subjects. It appears several times a year but cumulates the year's output in a final annual volume.

Book trade lists are published for the more important foreign countries, also, and it is thus possible to learn what books have been published. These trade lists, however, include both technical and non-technical books; and in all these lists the entries are very brief, giving merely titles, prices, publishers and, in some cases, the dates and number of pages. But book titles are often ambiguous or incomplete and, with the high cost of present-day technical books it is usually desirable to have further information before purchasing. Book reviews in scientific, technical, and trade journals (though not always ably written) afford the best information, but these reviews are widely scattered and few individuals find it possible to keep in touch with reviews in any large number of journals.

The Technical Book Review Index, issued quarterly by the Technology Department of the Carnegie Library of Pittsburgh, is the only publication devoted to recording reviews of new books in the fields of science and technology. It constitutes a record of the reviews in several hundred journals and includes many books published abroad. Its chief function is to cite accurately the sources and length of the review, but information is also given regarding pages, price, date, and publisher. Also, whenever possible, extracts from reviews are quoted, so that in many cases the reader gets, directly from the *Index*, sufficient evaluation of the book without consulting the reviews at all. The *Technical Book Review Index* is not intended to compete with existing book trade publications in suggesting books on any *subject*. It is, therefore, arranged alphabetically by names of authors. Incidentally (since the best books are the ones most likely to be reviewed) it is possible for the user to glance through the *Index* and quickly note the important works in his field. Each issue forms a pamphlet of 130 to 150 pages, and some 6,000 reviews are recorded annually. The price is 25 cents a copy or $1.00 a year.

Science News-Letter, December 24, 1927

Scientific Advances, 1927

(*Continued from page* 413)

Contrary to the usual notion that men of genius are physically frail, a study of several hundred great musicians of the past two centuries shows that they were an unusually healthy lot on the whole, Dr. James F. Rogers of the U. S. Bureau of Education reported.

A child gorilla's use of its hands was studied by Dr. R. M. Yerkes, of Yale University.

A study of why high school students fail in their course revealed that in a large percentage of cases teachers do not realize the basic causes of failure.

The effect of noise on a typist's efficiency, tested by Dr. Donald Laird at Colgate University, showed that the typist could keep up her accuracy only at the expense of speed and with a heavy drain on her energy.

Allowing children to give way to their impulses was denounced by Dr. Charles W. Burr, neurologist, who urged teaching children to control their emotions as a means of race improvement.

Adults up to the age of 50 learn better than children, experiments by Dr. E. L. Thorndike, professor of psychology at Columbia University, showed.

The nerve center which controls emotions was located as a very small section of the optic thalamus, in the old primitive part of the brain, as a result of experiments by Dr. Philip Bard at the physiological laboratory of the Harvard Medical School.

Radio

The International Radio telegraph Conference revised the world laws governing radio.

Reception of short length radio signals was found to improve during periods of high sunspot activity.

The experience of the U. S. S. Kittery with a radio compass during hurricane weather indicated that the intensity of static may be of use in detecting and locating these disastrous storms at a distance.

Five-meter wave experiments by the General Electric Company shows that these short waves seem to cast shadows much like light.

Quartz plate was developed by the U. S. Bureau of Standards as a standard of radio frequency, bringing agreement between frequency standards of different nations to three parts of 100,000.

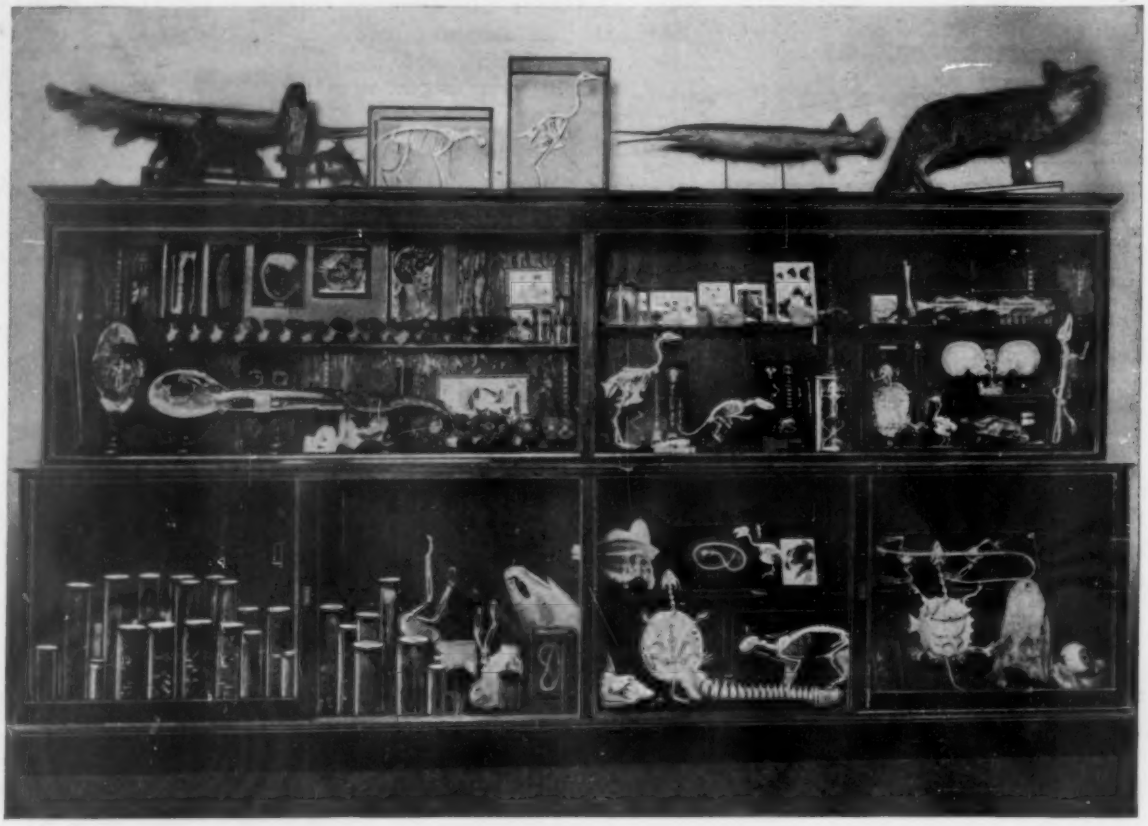
Station WGY at Schenectady operated on 100 kilowatt power using the world's largest vacuum power tube of that power.

Broadcasting upon low wavelengths was begun, necessitating adapters to most ordinary receiving sets.

Electron tubes operating directly on house supply alternating current were developed.

Science News-Letter, December 24, 1927

Demonstration Materials *for the* Biological Sciences



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December 31, 1927

GEOPHYSICS

Forty Mile Holes May Supply World's Power

By James Stokley

Some day the world's coal supply will be exhausted.

Then where will the world's supply of energy come from?

There is the possibility of using water power. Power may be obtained from the tides. Or perhaps directly from solar radiation.

But though the earth may yield up all of its available coal, there will still be energy left within it.

In digging some of the first of the great tunnels through the Alps, which, though high above sea-level, were really a mile or more below ground—in this case the top of the mountain—men were prostrated by the heat.

Hades has always been thought of as a hot place, and has been placed down in the center of the earth. What are the possibilities of tapping the fires of hell, or at least what nearest correspond to these ancient ideas?

It is generally believed that the center of the earth is hot, even though scientific modernists may have given up the idea of these regions being presided over by a fireproof, non-inflammable devil.

Not so many years ago speculations on obtaining heat from the earth were regarded as almost as much nebulous vaporizing as the steam itself emitted from the hot springs in various parts of the world.

But a few years ago Sir Charles Parsons, inventor of the steam turbine and one of the most distinguished of British engineers, made a suggestion. He proposed that scientific men should cooperate in sinking a shaft into the earth twelve miles deep. The suggestion was really a very conservative one, because he did not say that the shaft would be sure to bring untold wealth to its backers, or anything of the kind. The chief reason for doing it, as he said himself, was "We don't know what is down there, and we ought to."

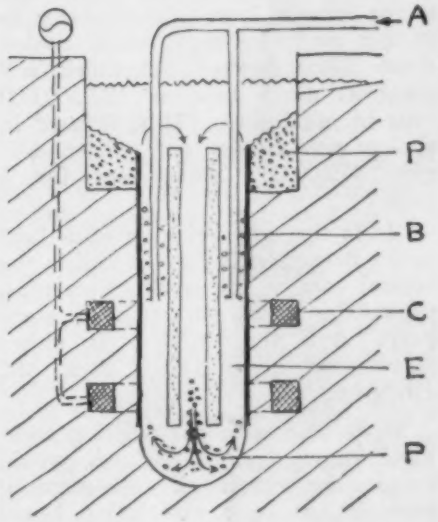

DIAGRAM OF HIGH TEMPERATURE BORE HOLE, for using the earth's heat for power, as proposed by John L. Hodgson, British engineer. This diagram is taken from Mr. Hodgson's book, and shows the method of digging the hole. A indicates pipes for introducing compressed air; B represents the bubbles of heated compressed air; C the alternating current circuits to melt the aluminum alloy, E, of the same density as the rocks through which the hole is bored.

Now another British engineer has carried the problem even further. At the recent meeting of the British Association for the Advancement of Science, in Leeds, the question came up again. Before the section on engineering of the association a paper was read by John L. Hodgson. In this paper he told of his exhaustive studies of the possibilities of digging such a shaft and using it as a source of power.

First of all is the amount of heat in the earth. According to Mr. Hodgson, it is 31 million times as great as the world's coal supply. The latter, he estimates, is 8,000,000,000,000 tons. This would raise the temperature of 6,400,000,000,000,000 tons of water from the freezing to the boiling point.

Why worry about our diminishing coal supply with all that heat beneath the soles of our shoes? But, asks the layman, isn't this supply of heat in the earth also limited, and if it is used up, won't it leave the earth a dead and cold planet, perhaps like the moon?

To this Mr. Hodgson responds with an emphatic "No!" As a matter of fact, the heat in the earth is continually being lost anyway. First it is conducted through the crustal rocks to the surface, and then it is radiated out into space. According to his estimates every square mile of the earth's surface radiates in a minute and a half as much heat as would be obtained by burning a pound of coal. If only 20 per cent. of this could be utilized as it flows out, a single square mile of surface would produce 40 horsepower. A thousand tons of coal burned in a second would produce the same amount of heat that the earth loses in a second. But instead of waiting for the heat to come to the surface, the best way seems to be to go down after it.

Even though all this heat is going out of the earth, it does not mean that our planet is getting cooler. This is what Mr. Hodgson says:

"This heat loss is wholly or partially balanced by new heat which is continually being generated in the earth's interior by rock friction, chemical change and radioactivity.

"The rate of heat production due to rock friction and chemical change has never been estimated.

"The rate of heat production in the surface layers due to radioactivity, however, seems to be more than suf-

(*Just turn the page*)

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Science News-Letter, Dec. 31, 1927.

Forty-Mile Hole for Power

(*Continued from page* 417)

ficient to make up for the relatively small amount of heat lost by radiation.

"It is therefore probable that the earth is getting hotter, and that the vast store of heat is increasing rather than diminishing."

Various attempts, in most cases quite successful, have already been made to use the heat of the earth. Even the primitive Maoris in New Zealand make use of hot springs for washing and cooking, while those in Iceland have long been used to aid the growth of vegetables.

Power from the earth, however, is more modern. There are three principal places where it has been accomplished, in California, in Italy and in Japan. The American installation has been in Sonoma County, about 105 miles north of San Francisco. This is a region somewhat resembling Yellowstone Park in that it contains a great number of hot springs and "mud baths," though real geysers are lacking. Five holes have been bored to a depth of about 450 feet in this region. Steam comes to the top with a pressure of 300 pounds per square inch. After allowing for losses in transmission, this gives 4,500 kilowatts of electricity, enough to supply heat and power for a good-sized town.

In Italy, at Larderello, in Tuscany, about 45 miles from Florence, is one of the most famous natural steam power plants. Prince Piere Ginori Conti, an Italian nobleman, has superintended this operation. The deepest of the twelve holes which have been sunk in the region there abounding in natural steam is 700 feet. From them is obtained 7,500 kilowatts of electrical power.

In the city of Beppu, on the island of Kyushu, in Japan, a start has been made to use power from hot springs. Here a small plant has been erected, while plans are under way to enlarge it.

These natural steam power houses are quite different from what Mr. Hodgson proposes, however, even though there are many places in the world where such projects might be carried out. In these places, the hot water or steam is produced by water from below passing through hot surface rocks. These, he says, may hold surprisingly large amounts of energy in the form of heat. One cubic mile of hot rock, he says, when cooled down 1,000 degrees Fahrenheit will yield as much heat as 182,500,000 tons of good coal. This, if used in a plant only 20 per cent. efficient will give 47,400,000 horsepower for a year.

"It is the vast reserves of a heat in the deeper crustal rocks and in the central core of the earth which must prove the great attraction to engineers until the problem is either solved or abandoned," says Mr. Hodgson.

To do this with our existing technical knowledge, he declares, would require the transfer of some material particles, as by a circulating liquid or gas, from the lower regions to the surface. If you hold a silver spoon in your hot coffee, the handle of the spoon soon becomes hot. Here the heat is conducted much as electricity is conducted along a wire. However, Mr. Hodgson does not believe that the heat that could be brought from many miles below the earth's surface to the top by any such means would be enough to pay for the cost involved. Neither does he think it practicable to use thermocouples, pairs of two different metals which give an electric current when heated. The current is too small.

Accordingly he suggests a bore hole, made double in form. Through a center pipe water descends from the surface. At the bottom it comes in contact with the outer wall and the heat of the earth at this depth converts it into steam. The steam then flows to the top to drive engines. If such a hole were a foot in diameter and 30 miles deep, he calculates that it would yield about 4,000 horsepower under ordinary working conditions, for the first 500 years.

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Scientists Discuss Bad Habits, Floods and Electrons

The annual meeting of the American Association for the Advancement of Science, with numerous associated organizations, held in Nashville, Tenn., from December 26 to 31 brought together several thousand of the country's leading scientists. A few of the most interesting and important papers are reported on this and the following pages. Next week more will be presented.

New Cure for Bad Habits

A new story of how habits are formed and how they may be cured was advanced before psychologists of the American Association for the Advancement of Science by Dr. Knight Dunlap, professor of psychology at Johns Hopkins University.

Bad habits, such as stammering, biting finger nails, or using a slang phrase can be overcome by voluntarily doing the undesirable thing, according to Dr. Dunlap's theory, and he described cases in which this method has been tried and found successful.

The psychologist's first subject to try the habit cure was himself. To break up the habit of writing "hte" on the typewriter for "the", he set to work deliberately and wrote half a page, singled spaced, of the "hte" combination, with the thought in mind that this was a "word" that he would not write in the future, unless it was done deliberately. About a week later he put in a second practice period, writing about one-third of a page. Since then, in a period of three months, the error of typing has not occurred, even once, he stated.

The theory is being tested with stammerers in a public school, Dr. Dunlap said, with favorable results.

"In the case of stammerers, the vital point is to study the specific type of stammering, and then induce the patient to reproduce voluntarily his characteristic verbal performance, criticising and assisting him until his voluntary stammering is as nearly as possible like his involuntary," he reported. "From that point on, the technique is complicated, and we do not expect to have it perfected until many cases have been experimentally subjected to it."

Thumb sucking and similar wrong habits of two- and three-year-old children have been treated at the Child Institute of Johns Hopkins University, he said, with results that show the method is useful even at such early ages.

In all cases patients have been selected who desired to cure the bad habit, for one reason or another, and have been carefully instructed that the voluntary performance, under the experimenter's control, would assist in abolishing the undesirable behavior at other times.

Dr. Dunlap's theory is in opposition to the generally accepted theory that repeating an act tends to fix it as a habit. Repetition in itself is important only because it brings into play other factors which establish the habit, he believes. In experiments so far conducted, it has been assumed that attention, expectation, and desire are among the important factors in making and breaking habits.

Science News-Letter, December 31, 1927

Shortest Men in Tropics

The shortest people in the world are found in the climates of extreme heat or cold where the food supply is difficult and precarious, Prof. R. Bennett Bean of the University of Virginia told the Association.

The Negrillos of central Africa average around four feet four inches, according to Professor Bean's figures, while the Aymaras of central South America are close seconds. Next to these groups come the Eskimo, Lapps and Siberians, who live in regions of Arctic cold with a poor food supply. The tallest people, Professor Bean pointed out, are found in the temperate climates where active life is possible and an abundant food supply prevails, notably around the shores of the Baltic Sea, eastern Africa, and the plains and pampas of the Americas.

"Looked at in its broadest sense," he stated, "environment molds the individual, selection retains the fittest under different environments, and heredity carries on the results.

"Certain stocks may move into areas for which they are not fitted and remain for a time. Such conditions exist throughout the world today where recent movements of peoples have taken place, but ultimately there is a survival of the stock best fitted for the environment. The unfit stocks disappear in time by amalgamation, eradication or dispersal."

Sea areas and probably sea food have an influence in reducing stature by increasing the iodine intake, Professor Bean stated. The present Mediterranean peoples, for instance, and the primordial British, have small statures and so also the Japanese, yet they come from taller continental stocks.

Science News-Letter, December 31, 1927

Indians from Cro-Magnons?

The possible claim of the red-skinned natives of the Americas to descent from the noblest line of the Old Stone Age in Europe was set forth here recently by Dr. Ales Hrdlicka, noted anthropologist of the U. S. National Museum, Washington, D. C. Dr. Hrdlicka has just returned from a European trip during which he re-examined practically all of the known remains of paleolithic man. Speaking before the anthropological section of the American Association for the Advancement of Science, he outlined certain striking similarities both in bodily structure and in cultural customs between the Indians and the latest of the races of the Cro-Magnon type.

Dr. Hrdlicka said in part: "The recent revision which I have made of practically the entire extent of skeletal material from the Aurignacian times throws important new light on the problem of the Aurignacian ('Cro Magnon') man, a light which is at considerable variance with previous assumption. The new conclusions are in brief as follows:

"Early Aurignacian skeletal remains are exceedingly rare; the mass of the known remains belongs to the later, evolved, Aurignacian.

"The tall and powerful men of the Grimaldi caves represent not a racial character, but individual or a family variation. There are three of these skeletons, all male and all approaching giantism. Other skeletons from the same place are of ordinary dimensions.

"The assumed superiority of the brain of the Cro-Magnons over other races, past and present, is not sustainable, especially if the influence of stature on the size of the skull is discounted.

"The two negroid skeletons of Grimaldi (now preserved in the Museum of Monaco) are negroid more or less only in their facial appearance. Their low orbits, the forehead, the cranial vault, and all the main characteristics of the skeleton are so close to the rest of the Grimaldi individuals and to other members of the Grimaldi race, or Upper Aurignacians, elsewhere, that they can safely be regarded as fundamentally of

(Just turn the page)

Indians from Cro-Magnons?

(*Continued from page* 419)

the same type and derivation. The negroid features of their face may be duplicated among other non-negro races, particularly the Malay and some of the American Indians. They differ very perceptibly even in the two skeletons.

"The supposed much greater antiquity of the two negroid skeletons is not supported either by their physical characteristics or their state of preservation, and the matter would seem to need a reconsideration. The case was plainly a double burial, and as such the remains may have been introduced into strata to which they would not properly belong.

"Some of the most characteristic and distinguishing features of the later Aurignacians relate to the shape and size of their ribs, which are unusually broad and strong; and to the shapes and relative sizes of their leg bones (tibia and fibula). The special characteristics of the leg bones extend as far as the Predmost skeletons of Moravia and the Paviland skeleton of England.

"There are growing indications that the uppermost Aurignacians may have been closely affiliated with the *faraway* European or Siberian ancestors of the older oblong-headed aboriginal Americans. There are many features in common to the two. The vault of the skull is often very similar in shape and size. Low orbits and other facial characteristics of the Aurignacians are also now and then met with in the Indians. There are certain Aurignacian-like similarities in the aboriginal American stone and bone culture. The habit of burying quantities of red ocher with their dead, was also common among the American Indians. While none of these items are decisive, they are nevertheless suggestive; and there is no inherent impossibility in the later Aurignacian influence, both morphological and cultural, reaching the old stock which eventually gave us the Indian. There are many indications that from the Middle Aurignacian times man began steadily to increase and extend over the earth; and that he remained much the same in physique through the succeeding terminal parts of the Paleolithic period and up to the Neolithic times when, according to the best evidence we now possess, he began gradually to extend or advance over into America."

Science News-Letter, December 31, 1927

(*Additional reports on page* 421)

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Electrons Like X-Rays

Experimental evidence in favor of some of the newest developments in electrical theory was reported to the American Physical Society by Dr. C. J. Davisson of Bell Telephone Laboratories, New York City. These experiments were concerned with the measurement of the way in which a beam of electrons is scattered by a single crystal of nickel. They showed that the scattering was governed by the same laws as those which govern the scattering of X-rays by a crystal.

"The scattering of X-rays by a crystal results in the production of strong scattered beams in just certain directions," Dr. Davisson stated, "and this fact has always been explained on the hypothesis that X-rays are an electromagnetic wave disturbance of the same sort as radio waves and visible light. Our experiments show that a beam of electrons shows these same characteristic scattering effects as X-rays. The inference seems to be that there is some sort of a wave-motion associated with the motion of a beam of electrons."

The experiments, which were performed jointly with Dr. L. H. Germer of the Bell Telephone Laboratories, showed that the observed wave-length of the electron beam was exactly that which is predicted by the quantum theory.

Describing the experimental method, Dr. Davisson explained that the source of the electrons was a hot filament just as in ordinary radio tubes. The voltage used ranged from about fifty to 375. The beam of electrons impinged on a nickel crystal, and some of them were absorbed in it, while others were scattered back from the surface. Of those that are scattered back some come back without having lost any speed—they have elastic encounters with the crystal like the impact of a billiard ball on a cushion.

A little collecting device was arranged so that it would be moved to various positions in front of the crystal to find how many electrons were scattered in the various directions without loss of speed. With this arrangement the number of electrons scattered in different directions was found to depend on the direction in the same way as does the scattering of X-rays by a crystal.

"The situation confronting physicists with regard to electrons is now something like the dilemma confronting the theory of light," the speaker declared. "For many years all the facts concerning light could

(*Just turn the page*)

Higher Floods Possible

High though the 1927 floods of the Mississippi were, and the most disastrous in our history, they did not represent the highest possible. It is conceivable that a future one may occur with crests two to four feet higher. This was the opinion expressed before the symposium on floods at the meeting of the American Meteorological Society by Dr. H. C. Frankenfield, in charge of the flood investigations of the U. S. Weather Bureau. Dr. Frankenfield was careful to add, however, that the chances of the maximum occurring are exceedingly remote.

"The lower Mississippi floods," said Dr. Frankenfield, "are caused mainly by heavy and favorably distributed rains over the great central basins. The Missouri River above the mouth of the Platte, and the Mississippi River above the mouth of the Wisconsin, do not contribute materially. In 1927, the time, amount and distribution of the rains was so favorable that the greatest flood in our history occurred.

"The amount of contributing rainfall for the floods of 1922 and 1927 did not differ materially and other factors were materially alike in January and February. The difference resulted from the March and April precipitation, the excess during April, 1927, determining the question in favor of 1927. The water depths over the entire basin from January to April, inclusive, in 1922 and 1927 were 10.58 and 10.79 inches, respectively, a difference of only 0.21 inch, not enough to cause any material difference in flood crests had it not been for the differences in the character of the distribution.

"Speaking in very general terms, a water cover of about 10 inches over the Mississippi basin from January to April, inclusive, will probably result in a more or less great flood from Cairo southward. The flood of 1927 did not exhaust the possibilities as to flood crests. Had the levees remained intact the stages in 1927 from Cairo to the Passes would have averaged a few feet higher than those recorded, and under the most favorable combination of contributory factors even still higher stages could occur."

The methods by which he has predicted disastrous floods of the Mississippi weeks in advance as told by Dr. Isaac M. Cline, in charge of the New Orleans Weather Bureau, were one of the features of the symposium.

The Mississippi has reached high stages more frequently in recent years than in times gone by, said Dr. Cline, even though the historic floods of 1782 and 1796 probably carried a greater volume of water than the flood of 1927. The reason for this is, he explained, that there has been great improvement in recent times to levee construction, which has held back the waters in the channel, that otherwise would have flowed over the land.

"Increase in the strength and height of levees has decreased the frequency of crevasses," Dr. Cline said, "but has increased the danger of disastrous overland floods from such breaks as occur, because of the increased head of water within the levees. Hence the forecasting of overland floods is of greater importance to the general public than is the forecasting of channel floods. Protection of life and property from overland flood waves requires a forecast of the rate of travel of the wave, and the closest approximation to the depth of water that may be expected at various points.

"The rate of travel is governed by the character and slope of the land. Overland floods in Louisiana have been found to travel at a rate of about 8 miles per day, air-line distances. In Mississippi the rate of travel is about 50 per cent. greater than in Louisiana.

"To forecast the depth of overland floods, topographic maps are absolutely essential. The first efforts at such a map for the Atchafalaya Basin was prepared by the Weather Bureau during the emergency in 1927, so that warnings could be issued for the overland flood following the Bayou des Claises crevasses. This information was also given to the U. S. Engineers and others who could make use of the information in helping the people out of the flooded area."

Science News-Letter, December 31, 1927

Storms Grow in Travel

How a great "cyclone" or general storm area, increases in size as it moves northeastward across the United States and Canada, or the western Atlantic, was described by Dr. W. J. Humphreys, of the U. S. Weather Bureau at Washington.

"As a general or cyclonic storm moves northeastward across the eastern United States and Canada," he said, "or over the Western Atlantic, it often increases rapidly in size and intensity. This storm consists of a swirl between cold air from the north on the northwestern side and warm humid air on the southeastern side.

(*Just turn the page*)

Storms Grow in Travel

(*Continued from page* 421)

"As the storm moves farther north the cold side becomes still colder while the warm side changes but little in temperature owing to continuous condensation. Also in this part of the world, there are no high mountains to block off the free flow of either the cold air from the north or the warm humid air from the south. That is, as the storm moves northeastward the difference in temperature between its warm and cold sides increases, and the winds are but little obstructed. It therefore grows larger and stronger the farther it goes in this direction and in this region."

Dr. Humphreys also told why these storms increase faster by night than by day.

"In the eastern United States the northwestern portion of a general storm area is free, or nearly so, from clouds, and the southeastern cloud-covered," he explained. "The cloudy portion cannot cool much by radiation at night, while the clear portion can and does. Similarly, on the cloudy side very little heat gets through to the earth from the sun, while on the clear side there is abundant sunshine.

"Evidently, then, the temperature difference between the two sides of the storm becomes greater during the night and less through the day. But the intensity of the storm increases with this temperature contrast, hence, in the eastern United States, and in various places, the general or cyclonic storm grows faster by night than by day."

Science News-Letter, December 31, 1927

The population of Java has doubled in 25 years, a remarkable rate of increase.

Roots of the cat-tail plant are rich in starch and make nourishing food.

Records indicate that Indians of the Iroquois tribe obtained as high a yield in their crops as farmers of today.

BLACK WHITE or SPECKLED?

THE "COMMITTEE ON THE NEGRO"

organized for the anthropological and psychological studies on the American Negro published its first Anthropological paper in the *American Journal of Physical Anthropology,* Vol. X, No. 2. Dr. A. Hrdlicka, of the United States National Museum reviews this interesting and important subject and gives a bibliography of 269 titles.

Read the Anthropological paper on this great problem in the *American Journal of Physical Anthropology.*

Published by The Wistar Institute of Anatomy and Biology, Philadelphia.

Electrons Like X-Rays

(*Continued from page* 421)

be explained by assuming it to be simply a wave motion. Then the quantum theory, in the hands of Planck, Einstein and A. H. Compton, showed that radiation had also to be regarded as having something corpuscular about it. Similarly, for many years electrons were believed to be simply corpuscles of negative electricity. But now recent developments in quantum theory, confirmed by these experiments, show that there is something wave-like about them."

Science News-Letter, December 31, 1927

Impure Gelatine in Movies

The millons of dollars invested in the movies and the pleasure of the millions of people who daily attend them is based on chemical impurity in gelatine. This announcement, in effect, was made by Dr. C. E. K. Mees, director of the Research Laboratory of the Eastman Kodak Company.

"It has recently been found" said Dr. Mees, "that the sensitiveness of films is not due to the grains of silver bromide only but is in some way connected with the presence on those grains of specks of some other substance, and the Kodak Research Laboratories after a long and careful study have found that these specks are produced by an accidental impurity present in the gelatine. This impurity is derived from the plants eaten by the animals from whose skins the gelatine is made. There is only a very small amount of it in the gelatine, but it is a compound which contains sulphur, and when the gelatine is used for making the film, the sulphur reacts with the silver bromide and produces specks of silver sulphide on the crystals.

"In some way or other these specks increase the effectiveness of the light to which the film is exposed in the camera and enable the light to change the silver bromide so as to form a trace of metallic silver. Then this silver acts during developments as a nucleus on which more silver can deposit by the chemical process until the whole of the silver bromide crystal is turned into silver. Each of the original crystals of the film therefore after exposure to light becomes a grain of silver in the developed film, and it is of these grains of silver that the image projected on the screen is composed."

Science News-Letter, December 31, 1927

(*Additional A. A. A. S. reports on page* 425)

Forty-Mile Hole for Power

(*Continued from page* 418)

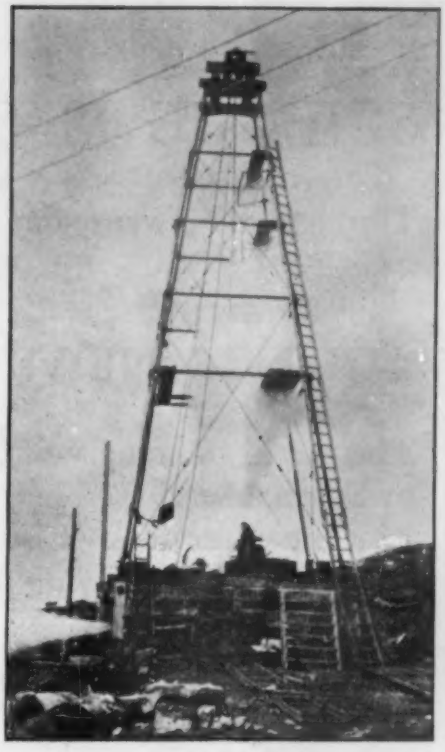
As the rock in the immediate neighborhood of the hole would give up its heat first, the yield would be greater at first. But even after 4,000 years, he estimates, the cooling would not have extended farther than 2,000 feet from the hole. If the hole were made larger, the yield would be somewhat increased, but the greatest advantage would come from making it deeper. Taking a hole 30 miles deep and a foot in diameter, an increase to ten feet in diameter would only increase the heat yield a third. But making it 40 miles deep instead of 30 would increase it about one and a half times.

Mr. Hodgson, as an engineer, has not been content with calculating what such a hole would do if we could dig it, but has actually worked out a scheme for making the hole!

Present mining methods make the limit of a hole by their use about 2 miles. Below that depth the pressures of the rocks become too great. But. Mr. Hodgson proposes a method of getting around this by something similar to hydraulic mining. Instead of using a stream of water to cut away the rocks, he suggests the use of a stream of molten metal—an alloy of aluminum. With this alloy, which has the same average density as the rocks it encounters, their pressure is balanced. Pebbles of quartz or flint carried by the liquid metal aid its work, while it is kept molten by electric circuits. When the desired depth has been reached the metal is removed and replaced by water.

Of course, since it is not even known whether the method would prove practicable, it is hard to estimate the cost of such a hole. However, he makes some rough comparisons of the cost of operation with that of an ordinary steam plant. An investment of about $2,500,000 at five per cent. would be required to yield 4,250 horsepower from coal at $5.00 per ton according to his estimate.

"The cost of a high temperature bore hole to produce the same amount of heat should scarcely be more than ten times this amount when the technique of making such bore holes has been adequately worked out," says Mr. Hodgson, "while the cost of the much shallower high temperature heat bore holes possible in volcanic areas should be able to compare very favorably with the cost of producing heat by any other method."



IF A DEEP BORE HOLE, such as is proposed by John L. Hodgson, British engineer, is ever made to utilize power from the earth, the top of it might look something like this. The installation shown here is at Lardarello, Italy, where Prince Ginori Conti has made use of natural steam as a source of power.

But the "high temperature" hole is not the only possibility. The engineer also proposes what he calls a "low temperature" hole. This consists of two bore holes, about 5 miles deep and connected by horizontal passages about 30 miles long. This 30 miles of horizontal passage, for the first 1,000 years, would produce an average of more than 4,250 horsepower, he believes. Such a system of holes, in his opinion, would not cost any more than ten times the cost of the present steam plant of like power. Then there is also the possibility of sinking it in regions where valuable ores are to be obtained and so reducing its cost indefinitely. Already a world shortage in such metals as zinc, tin and lead is in sight because all the pockets in which they occur within a mile of the surface are becoming exhausted.

With this system, a few workers would be required underground, and Mr. Hodgson suggests that they could be encased in heat proof suits through which air at about 60 degrees Fahrenheit circulated. This air could be obtained from tanks of liquid air either carried on trucks or by the workers themselves.

Apparently, then, our present methods of producing power are cheaper, but Mr. Hodgson's conclusion admirably summarizes the problem. This is what he says:

"We are, with regard to the problem of using the Earth's Internal heat, very much in the position of an eighteenth century 'outcropper' quarrying for coal in the hillsides of Yorkshire. Noting the dip of the strata, he could quite well reason that far below the surface there must be immense reserves of coal, which on the one hand he did not need to exploit because the hillside quarry provided for all his immediate needs, and which on the other he could see no possibility of exploiting at a profit because he knew nothing of such devices as the steam engine, the electric motor and the air compressor.

"Yet because the problem of making use of the deep lying coal seams was not lost sight of, men in Yorkshire today are mining coal thousands of feet below the surface by the methods and applications that were not even dreamed of by the 'outcropper' of two hundred years ago."

Science News-Letter, December 31, 1927

ZOOLOGY

The Hunters

Far in the north
  Wing through the night
Goblin-eyed owls
  Spectrally white.

Far in the south
  Saucer-fed snakes
Weave through the attics
  When the moon wakes.

Triune is death
  For the race of the rat—
Winged owl, scaled snake
  And velvet cat.

—*Elizabeth Coatsworth, in the New York Times.*

Science News-Letter, December 31, 1927

Aluminum was discovered just 102 years ago by Dr. Hans Christian Oersted, Danish physicist.

New York schools are experimenting with the use of moving picture reels to teach current events.

Travelers in the desert sometimes quench their thirst by drinking water stored by some of the desert plants.

The modern device of dressing sports contestants in different colors was a custom of the Romans.

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WOO John Wanamaker, Philadelphia, Pa.

WRAV Antioch College, Yellow Springs, Ohio

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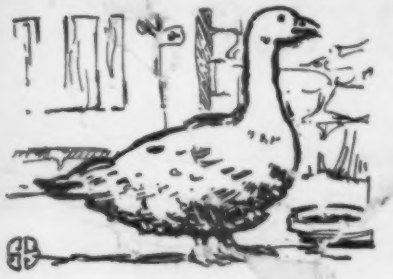
BIOLOGY

NATURE RAMBLINGS

By FRANK THONE



Holiday Goose

The Christmas holidays coming so soon after Thanksgiving, is rather hard on the poultry population. Many thousands of turkeys that escaped the late November massacre have lost their lives during the past few days and weeks.

Turkeys have been getting scarcer in this country of recent years, however, and the holiday goose is coming back into its own. Long before America was discovered, and with it the turkey, the goose held undisputed sway as the bird of the day at festal seasons. Even where turkeys are abundant there are many who prefer goose, for its flesh is moister and fatter than that of the American bird.

As the turkey is the most recent addition to the poultry yard, the goose was probably its first inhabitant, though possibly the duck might claim that honor. Both birds, as well as the common barnyard hen, were man's domestic companions long before the dawn of written history. The goose especially has had the esteem of primitive peoples, who dedicated it to one or another of their pagan gods. Even a nation of antiquity so recent and so civilized as Rome considered the goose sacred to Juno; the legend of the saving of the city by the alarmed cries of her flock at midnight is known to every one.

The goose is one of the most completely useable of all our domestic animals. Besides yielding a great lump of meat upon its involuntary demise, it gives us quantities of huge eggs before that event. It also supplies whole snowstorms of feathers and down for cushions and old-fashioned feather-beds, and can be plucked alive without apparent inconvenience. Finally, before the invention of metal pens, its quill-feathers made the best writing instruments; and before the invention of gunpowder those same stiff feathers winged the terrible clothyard shafts of the English archers. The goose, [illegible] defamed as a foolish bird, w[illegible] means of conquering a way [illegible]e, writing the treaty, furnishi[illegible] feast of amity and celebration, and at last supplying soft beds for the King and his men to sleep on afterwards.

Is it any wonder that a bird which has been so useful to Christians should be a favorite at Christmas?

Science News-Letter, December 31, 1927

Katydid Concerts Timed

Katydids and crickets hear with their front legs. Such is the conclusion reached by Dr. B. B. Fulton of Iowa State College, after a close observation of prolonged vocal concerts participated in both by delegged insect songsters and those with the full complement of extremities.

There are on the front legs of certain insects of the grasshopper family, organs similar in structure to those used for hearing by higher animals, Dr. Fulton explained to the association. Only the species having stridulatory or singing organs possess also the tympanun organs on the foremost pair of legs. Whether they actually serve this purpose or not, however, is a matter of much entomological wrangling, as are the functions of most of the senses in insects.

Dr. Fulton staged his first demonstration with ten male katydids commonly found on the prairies, placed in a cage where night after night they exhibited "almost perfect synchronization."

"The song of the group was continuous," stated the entomologist, "and as each individual started its series of notes anew it would fall in with the general cadence. It was only by detecting slight variations in the quality and volume of the chorus that one could be aware of the pauses in the individual songs. After observing the song of the whole group for two nights I removed four males to another cage at some distance from the first and with a small scissors cut off their front tibiae close to the femora."

The notes from these mutilated insects were not synchronized except as they happened to sound together at times, Dr. Fulton declared. He repeated the experiment with crickets and a species of Nebraska grasshoppers with the same results. The removal of the front legs did not injure the insects' health in any way, he was careful to explain, for those operated on lived as long as those left intact. Grasshoppers frequently kick off one or both hind legs voluntarily to escape capture, he added.

Such a simultaneous sounding of notes as the uninjured insects produced can hardly be a matter of accident, said Dr. Fulton, and appears as conclusive evidence that they can hear each other.

Science News-Letter, December 31, 1927

Fox Disease Like Human Ill

Causes of the epidemics that take off hundreds of valuable silver foxes on the fox farms of the West are beginning to come to light. One form of the fox disorders that have been known generally and vaguely under the term distemper, has been shown by Dr. R. G. Green and a group of collaborators at the University of Minnesota, to have many of the characteristics of encephalitis, a contagious inflammation of the brain.

Deaths from a simple epidemic of this malady have totalled more than 700, Dr. Green told members of the Society of American Bacteriology. Typical cases show weakness, convulsions and a lethargic state. The onset is usually sudden, while the animal dies within from one to three days after it is taken sick. The mortality of the disease as it occurs in nature runs from 10 to 25 per cent., but cases infected artificially in the laboratory are almost inevitably fatal. The causative agent has not yet been found, though a specific streptococcus is under suspicion.

The action of this causative factor seems to be neutralized by castor oil soap. Animals vaccinated by means of a soap-virus mixture appear to have resistance to artificial infection, Dr. Green declared.

Fur farmers throughout the country and in Canada are bending every effort to prevent contagious diseases in their foxes, while Dr. J. E. Shillinger of the U. S. Biological Survey has been sent to cooperate with Dr. Green in the research at the University of Minnesota.

Science News-Letter, December 31, 1927

Ancient man discovered the four methods of preserving food, namely by drying, heating, freezing, and use of antiseptics, such as salt and smoke, long before the day of written documents.

In producing the perfume of the rose, chemists combine toluene, a coal tar distillate which smells like gasoline, with chlorine, a poison war gas, and treat it with another poison, potassium cyanide.

THE WORLD MOVES SWIFTLY

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